PART III

RESULTS

3.1

ULTRAVIOLET ABSORPTION SPECTRA

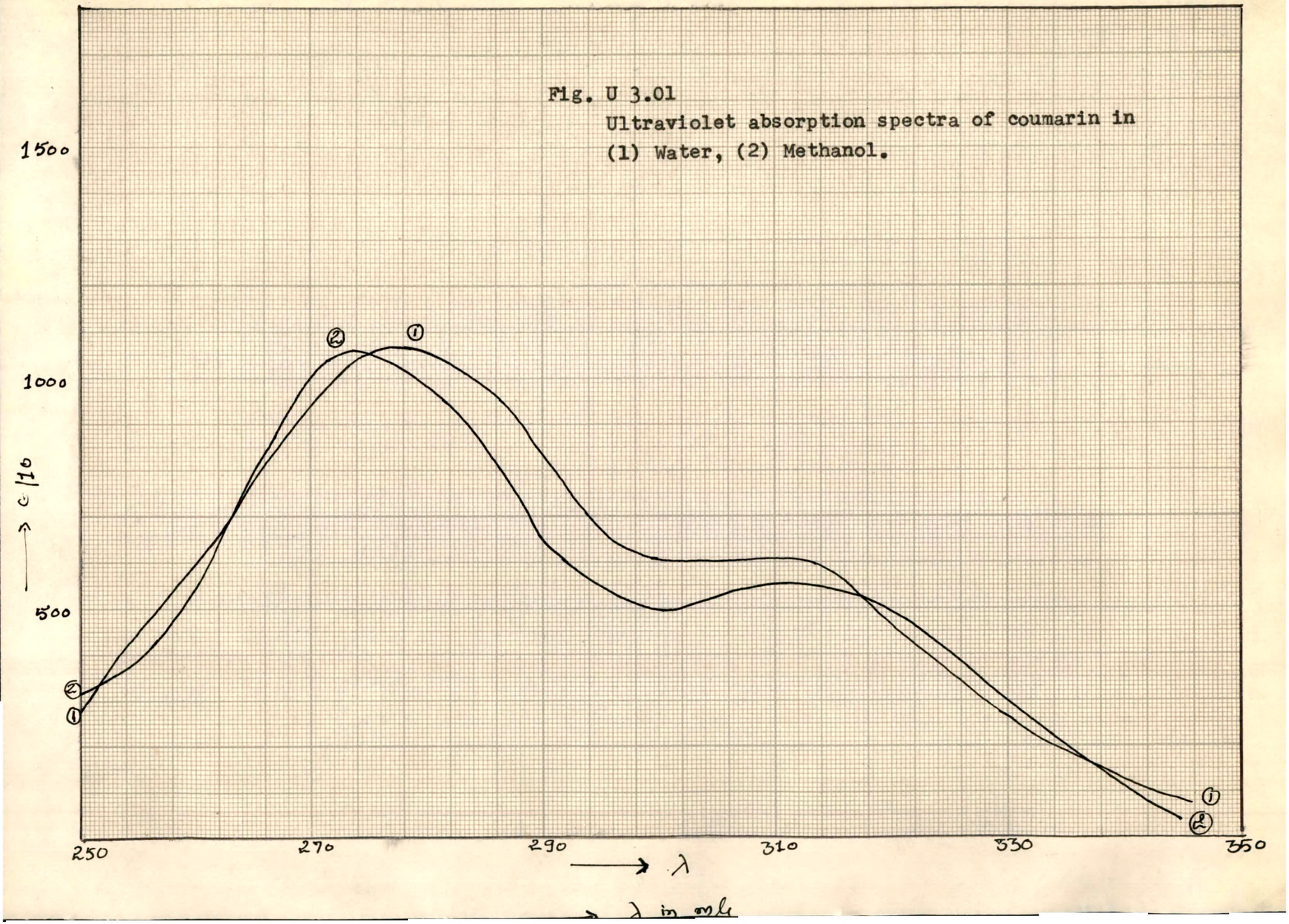

Fig. U 3.01
Ultraviolet absorption spectra of coumarin in
(1) Water, (2) Methanol.

Table U 3.01

Ultraviolet absorption spectra of coumarin

% methanol =	water	10	100
λ (mμ)		ε/ 10	
250	301	303	321
55	450	446	-
60	623	624	574
64	774	771	-
68	908	899	-
70	967	-	1019
72	1021	1018	1055
74	1046	1036	1064
76	1064	1046	1036
78	1068	1086	1017
80	1053	1064	-
82	-	1037	945
84	1000	1001	-
86	951	954	807
90	-	835	642
95	662	693	-
300	615	615	500
05	615	615	532
07	-	615	541
10	615	615	550
12	615	615	550
15	559	596	536
20	-	523	477
25	-	431	376
30	-	312	284
35	-	229	184
340	114	119	100

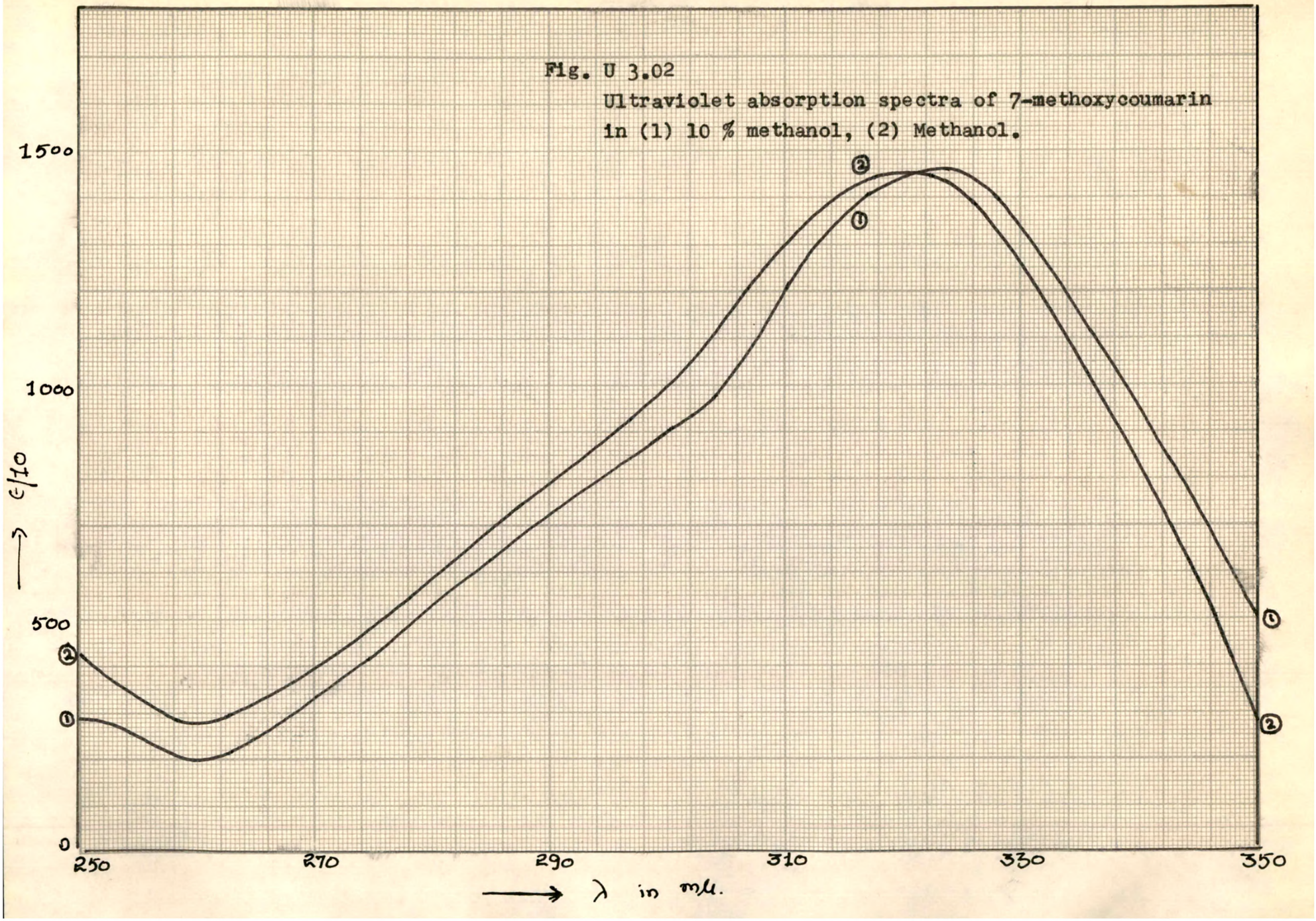

Fig. U 3.02
Ultraviolet absorption spectra of 7-methoxycoumarin in (1) 10 % methanol, (2) Methanol.

Table U 3.02

Ultraviolet absorption spectra of 7-hydroxycoumarin and 7-methoxycoumarin in aqueous methanols.

Compound :	7-OHI		7-MeOI	
% methanol	10	100	10	100
λ (mμ)	ε /10		ε /10	
250	235	259	289	394
52	237	262	279	-
54	220	264	259	358
56	192	259	223	-
58	169	218	-	299
60	169	191	209	-
62	175	186	-	289
64	192	204	239	-
66	220	227	-	334
68	249	255	303	362
72	307	318	372	422
76	374	391	448	502
80	462	464	538	587
84	508	537	611	677
88	588	619	687	757
92	642	701	767	856
96	709	782	836	916
98	748	819	-	952
300	795	864	916	995
05	939	1010	1071	-
10	1112	1183	1234	1304
15	1227	1347	1368	-
18	-	-	1429	1449
20	1304	1438	1443	1449
22	-	-	1453	1449
24	-	-	1453	1443
25	1347	1456	1453	-
30	1250	1383	1354	1275
35	1120	1201	1174	-
40	958	1010	971	-
45	728	764	-	-
350	489	464	474	289

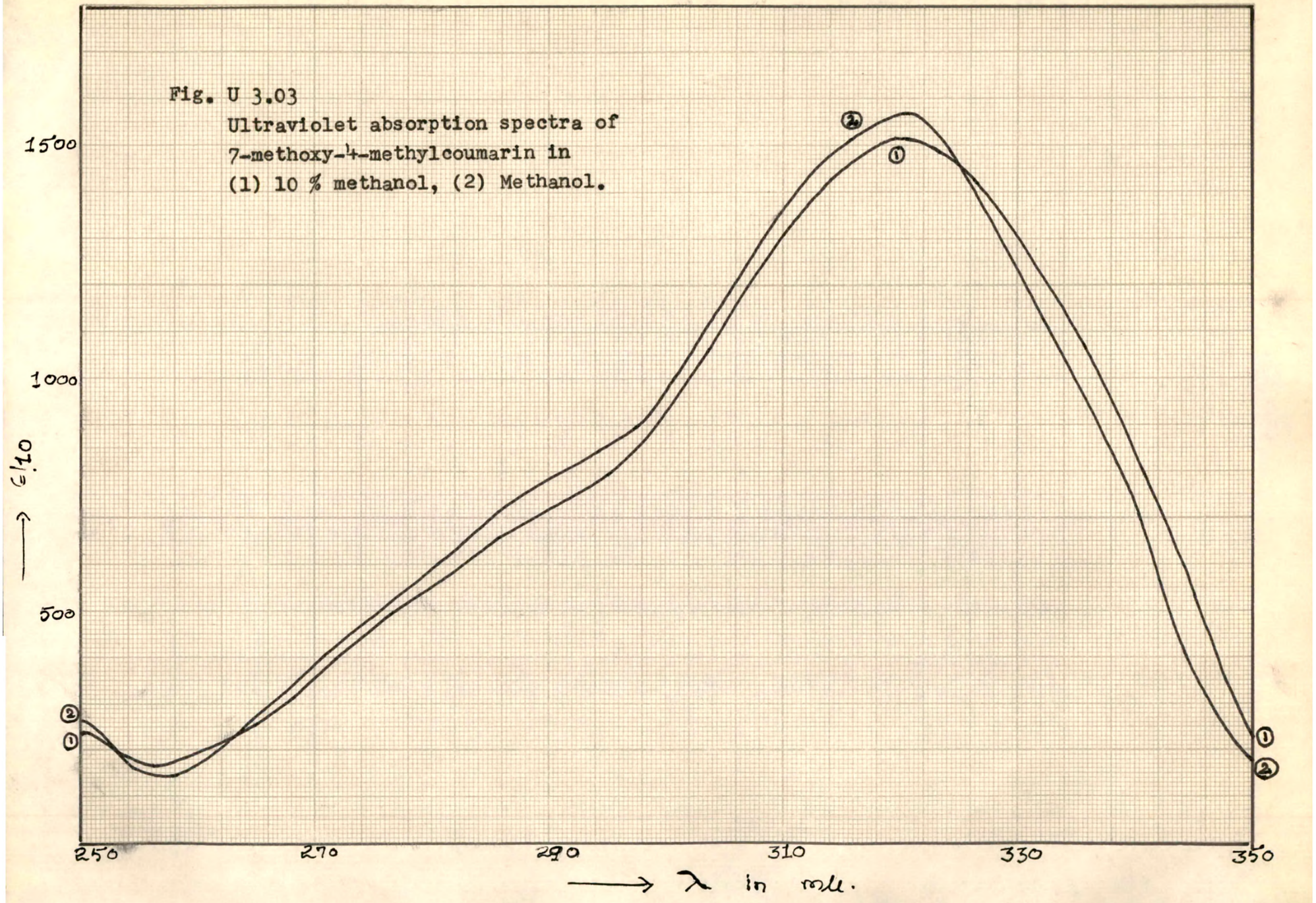

Fig. U 3.03
Ultraviolet absorption spectra of
7-methoxy-4-methylcoumarin in
(1) 10 % methanol, (2) Methanol.

Table U 3.03

Ultraviolet absorption spectra of 7-hydroxy-4-methylcoumarin and 7-methoxy-4-methylcoumarin in aqueous methanols.

Compound	7-OH-4-MeI		7-MeO-4-MeI	
% methanol	10	100	10	100
λ (mμ)	ε/10		ε/10	
250	-	231	244	267
52	-	-	220	201
54	-	-	191	164
56	187	198	175	148
58	-	176	179	148
60	-	-	196	180
62	220	187	223	214
66	268	238	294	294
70	330	299	374	382
74	385	363	453	479
78	433	429	527	569
82	484	495	599	644
86	539	557	667	731
90	590	618	723	787
92	-	-	744	802
94	629	-	779	848
96	-	-	826	863
98	715	737	877	916
300	-	-	948	991
02	836	854	-	-
04	-	-	1102	1154
06	970	1012	-	-
08	-	1080	1243	1321
12	1144	1221	1380	1441
14	1199	1265	1425	1488
16	1243	1320	1478	1515
18	1276	1350	1507	1552
20	1298	1386	1520	1563
22	1298	1408	1515	1532
24	1298	1386	1484	1478
26	-	1353	1428	1408
28	1221	1302	1375	1314
30	-	1232	1292	1224
34	1058	1102	1144	1049
38	935	968	961	844
42	790	770	719	567
46	-	-	445	281
350	378	301	233	108

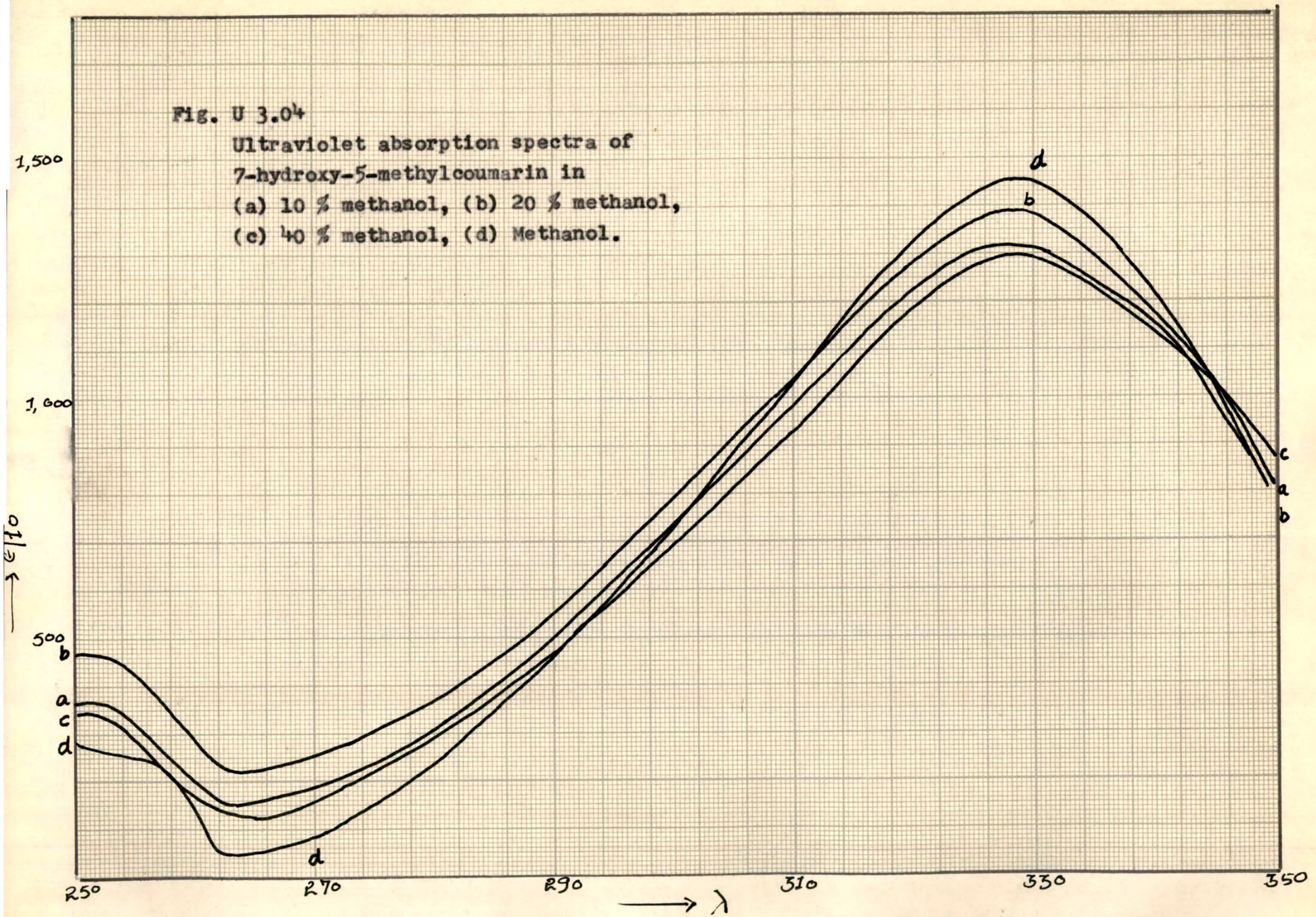

Fig. U 3.04
Ultraviolet absorption spectra of
7-hydroxy-5-methylcoumarin in
(a) 10 % methanol, (b) 20 % methanol,
(c) 40 % methanol, (d) Methanol.

Table U 3.04

Ultraviolet absorption spectra of 7-hydroxy-5-methylcoumarin in aqueous methanols.

% methanol	10	20	40	60	100
λ(mμ)			ϵ/10		
250	373	477	340	373	283
52	362	472	332	354	263
54	351	450	326	348	258
56	307	414	307	335	258
58	244	349	244	274	216
60	181	274	178	198	143
62	153	230	140	176	49
64	151	228	126	132	49
66	162	230	132	140	66
68	176	244	148	154	88
70	198	264	170	170	107
72	214	280	187	176	107
74	239	296	211	217	132
76	258	321	231	239	165
78	280	351	255	258	200
80	310	376	283	283	239
84	376	446	351	348	326
88	458	517	431	431	420
92	551	660	516	513	524
96	642	694	609	604	628
300	738	793	705	705	749
04	829	889	793	801	854
08	930	997	900	903	971
10	990	1056	949	958	1037
12	1067	1109	993	1013	1111
14	1097	1136	1059	1086	1173
16	1149	1204	1114	1136	1229
18	1191	1257	1152	1174	1283

Table U 3.04 (contd.)

320	1231	1295	1193	1218	1327
22	1265	1339	1221	1265	1367
24	1286	1355	1259	1289	1405
26	1311	1374	1278	1322	1432
28	1311	1394	1298	1330	1462
30	1311	1382	1298	1330	1451
32	1289	1367	1286	1333	1432
34	1268	1303	1268	1303	1405
36	1249	1283	1229	1273	1345
38	1191	1217	1191	1221	1283
40	1141	1191	1149	1185	1218
42	1081	1131	1103	1122	1149
44	1034	1070	1051	1067	1078
46	957	993	993	999	999
48	889	916	927	942	911
350	804	797	861	854	807

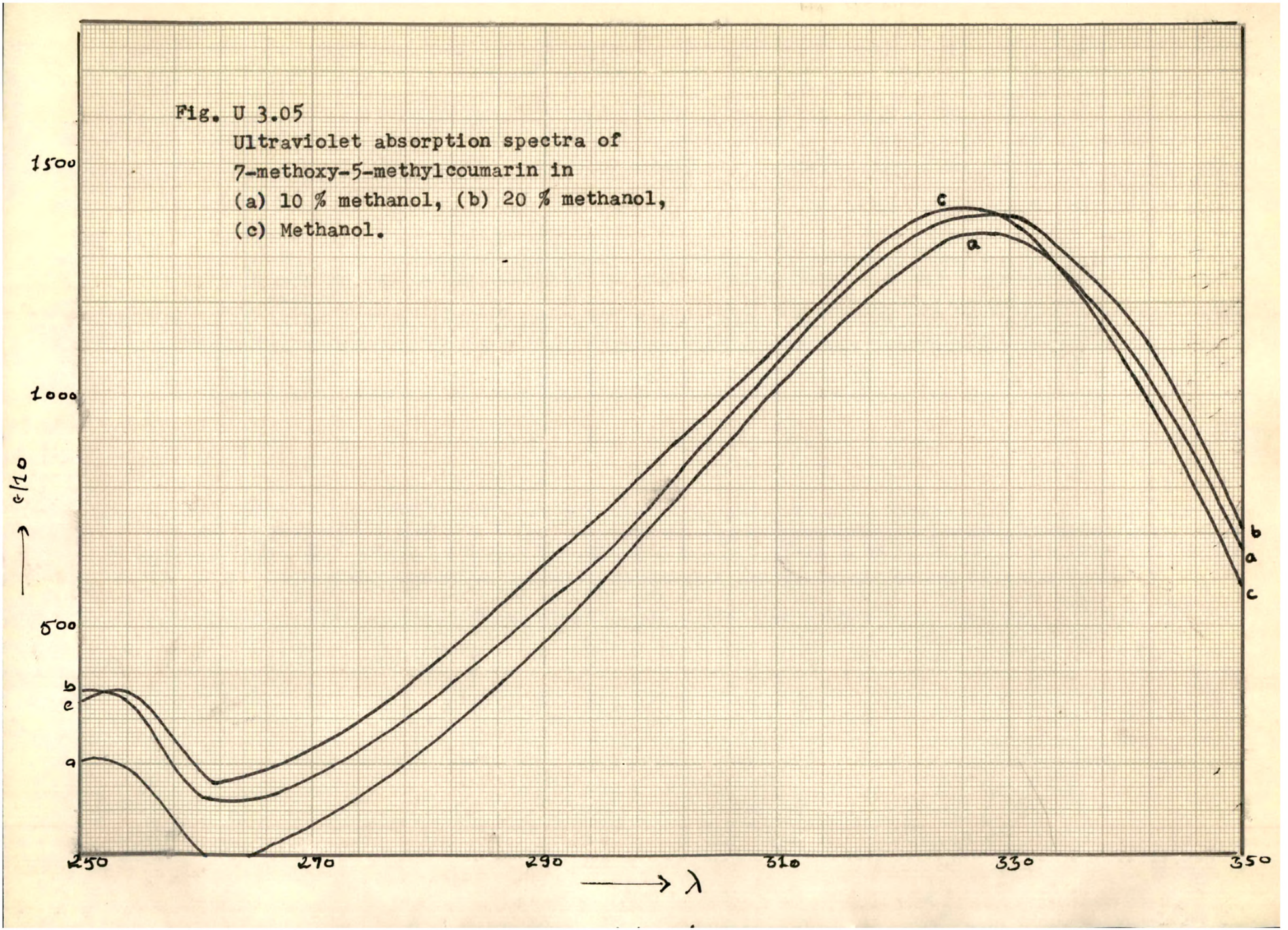

Fig. U 3.05
Ultraviolet absorption spectra of
7-methoxy-5-methylcoumarin in
(a) 10 % methanol, (b) 20 % methanol,
(c) Methanol.

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Table U 3.05

Ultraviolet absorption spectra of 7-methoxy-5-methylcoumarin in aqueous methanols.

% methanol =	10	20	40	60	100
λ(Mμ)			ε/10		
250	201	352	265	313	324
52	201	352	265	307	336
54	182	336	259	303	346
56	128	283	214	255	307
58	50	185	133	178	222
60	12	131	75	89	168
62	-	112	56	85	153
64	3	112	54	89	162
66	27	139	69	100	185
68	46	143	91	114	207
70	73	178	112	143	236
74	123	228	168	197	288
78	197	294	230	259	363
82	278	363	313	321	452
86	363	448	392	427	540
90	467	548	490	519	637
94	568	622	597	622	722
96	626	703	637	674	776
300	738	796	715	790	873
04	842	904	859	886	962
08	954	1012	964	1000	1052
10	1028	1070	1031	1060	1116
12	1077	1136	1089	1116	1162
14	1136	1174	1143	1176	1220
16	1182	1232	1193	1225	1263
18	1232	1271	1236	1244	1308
20	1271	1321	1271	1313	1344
22	1309	1348	1309	1373	1360
24	1329	1375	1341	1399	1380
26	1348	1398	1354	1387	1398
28	1348	1398	1369	1387	1398
30	1341	1387	1354	1387	1380
32	1317	1368	1341	1368	1332
34	1271	1321	1303	1323	1278
36	1255	1263	1215	1253	1182
38	1166	1193	1186	1193	1124
40	1096	1136	1118	1141	1051
42	1028	1066	1051	1056	973
44	939	981	966	973	892
46	854	900	886	896	799
48	776	815	799	807	707
350	660	699	668	691	583

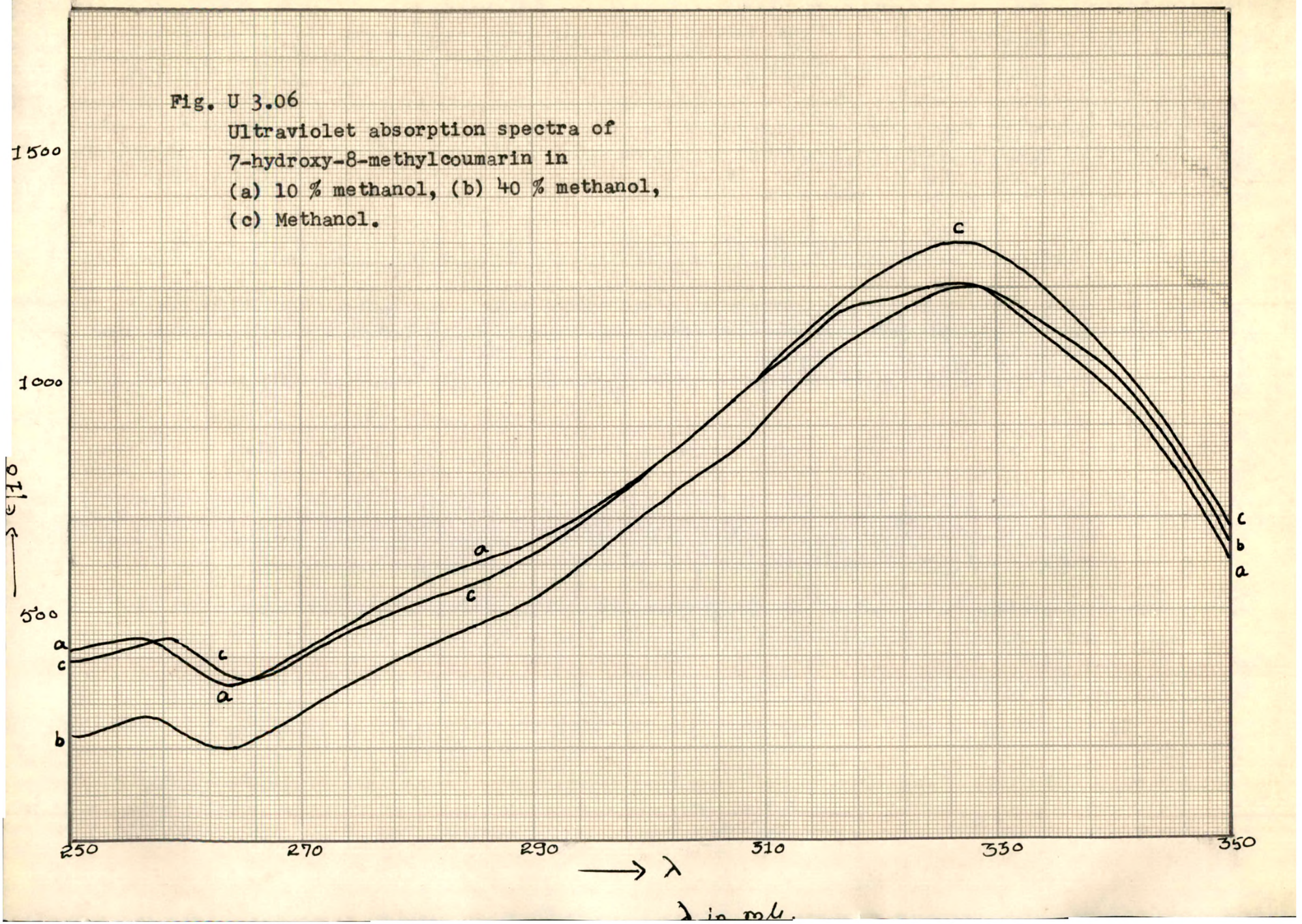


Fig. U 3.06
Ultraviolet absorption spectra of
7-hydroxy-8-methylcoumarin in
(a) 10 % methanol, (b) 40 % methanol,
(c) Methanol.

Table U 3.06

Ultraviolet absorption spectra of 7-hydroxy-8-methylcoumarin in aqueous methanols.

% methanol = λ(mμ)	10	20	40 ϵ/10	60	100
250	420	384	235	325	393
52	432	399	238	328	402
54	438	399	250	331	414
56	438	402	271	340	426
58	423	384	262	337	429
60	382	352	232	289	423
62	355	322	215	274	384
64	343	310	203	250	352
66	360	322	218	259	366
68	384	352	241	280	378
70	411	378	271	316	405
72	440	408	298	334	423
74	474	438	334	364	456
76	509	465	370	393	486
78	530	486	393	426	513
80	557	507	424	441	513
82	572	527	438	458	531
84	587	542	453	474	553
88	623	581	495	521	593
92	676	632	563	575	647
96	736	691	632	647	721
300	808	772	712	724	802
04	882	835	793	808	885
08	963	918	856	894	974
10	995	957	898	948	1022
12	1040	1001	971	1001	1072
14	1078	1040	1010	1043	1114
16	1114	1070	1060	1085	1162
18	1135	1093	1093	1123	1190
20	1174	1135	1129	1153	1240
22	1186	1159	1156	1186	1273
24	1204	1174	1186	1210	1287
26	1207	1195	1200	1234	1299
28	1207	1186	1192	1234	1299
30	1183	1171	1186	1219	1293
32	1156	1144	1165	1204	1264
34	1118	1118	1132	1171	1227
36	1085	1095	1096	1129	1180
38	1033	1046	1067	1093	1120
40	992	995	1016	1049	1064
42	936	948	959	980	995
44	861	873	891	924	921
46	787	823	817	843	843
48	709	739	742	778	763
350	617	662	665	679	667

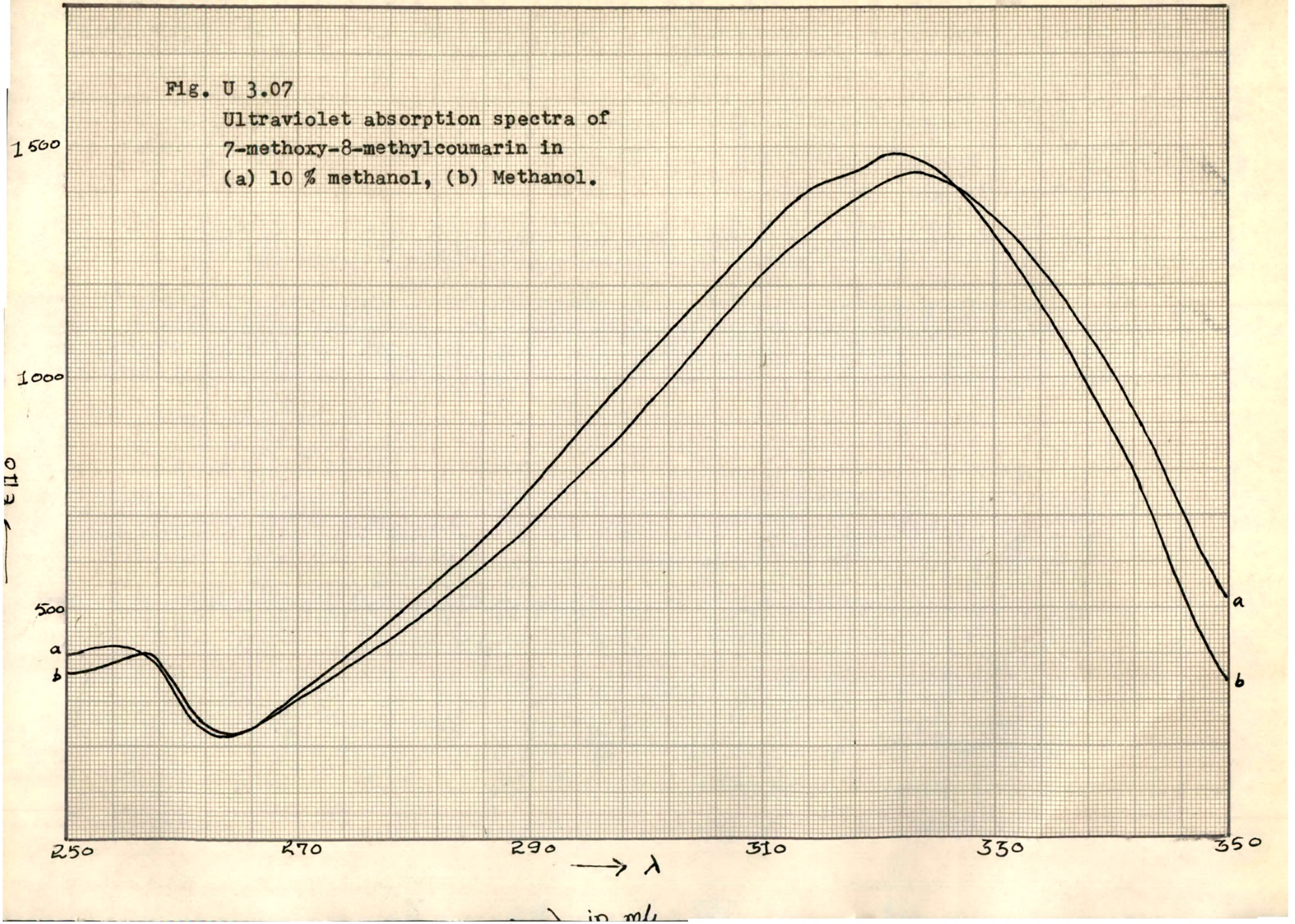


Fig. U 3.07
Ultraviolet absorption spectra of
7-methoxy-8-methylcoumarin in
(a) 10 % methanol, (b) Methanol.

Table U 3.07

Ultraviolet absorption spectra of 7-methoxy-8-methylcoumarin in aqueous methanols.

% methanol = λ (mμ)	10	20	40 ϵ/10	60	100
250	407	386	386	278	360
52	413	390	384	278	362
54	428	407	398	292	381
56	416	412	403	305	400
58	386	376	376	282	368
60	305	300	294	206	290
62	243	239	231	139	239
64	227	221	208	119	230
66	247	231	219	131	249
68	268	253	243	157	282
70	298	288	278	192	315
74	364	354	343	262	396
78	441	431	417	347	486
82	517	509	499	441	566
86	597	588	574	513	653
90	682	672	668	621	769
94	772	772	762	740	877
98	887	885	876	856	999
302	985	985	991	981	1114
06	1099	1095	1099	1099	1215
10	1224	1206	1210	1224	1316
12	1263	1257	1263	1277	1365
14	1303	1303	1318	1328	1408
16	1345	1348	1351	1377	1427
18	1377	1381	1397	1406	1448
20	1406	1406	1409	1434	1471
22	1422	1427	1430	1459	1484
24	1430	1430	1446	1463	1467
26	1430	1430	1446	1463	1438
28	1388	1402	1427	1442	1390
30	1348	1381	1418	1420	1324
32	1291	1291	1316	1326	1242
34	1243	1245	1269	1263	1161
36	1179	1181	1201	1185	1067
38	1101	1111	1150	1069	997
40	1028	1046	1060	1040	899
42	944	952	964	950	803
44	836	860	875	850	684
46	734	752	770	723	556
48	650	650	677	609	437
350	523	552	529	484	341

Fig. U 3.08
Ultraviolet absorption spectra of
5-hydroxy-4-methylcoumarin in
(a) 10 % methanol, (b) Methanol.

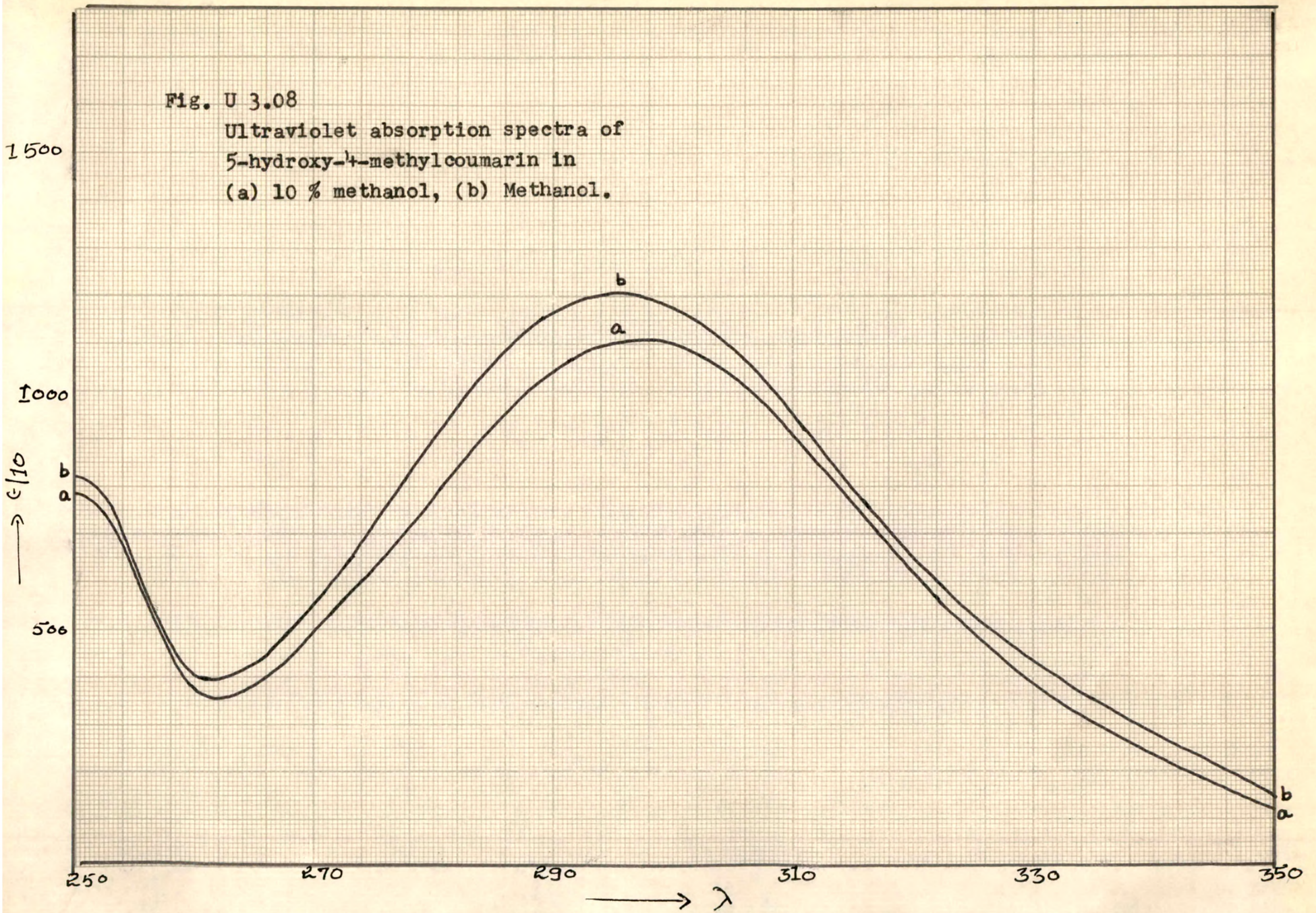


Table U 3.08

Ultraviolet absorption spectra of 5-hydroxy-4-methylcoumarin in aqueous methanols.

% methanol	10	100
λ(mμ)	ϵ/10	
240	595	675
45	719	782
48	766	801
50	786	823
51	783	-
52	772	807
56	575	576
60	377	401
70	488	559
80	788	-
85	934	1069
90	1045	1173
94	1098	1200
95	1110	-
96	1114	1208
97	1112	-
98	1110	1193
99	1108	-
300	1106	1180
01	1099	-
02	1088	-
05	1045	1104
10	910	944
20	632	654
35	293	-
350	129	143

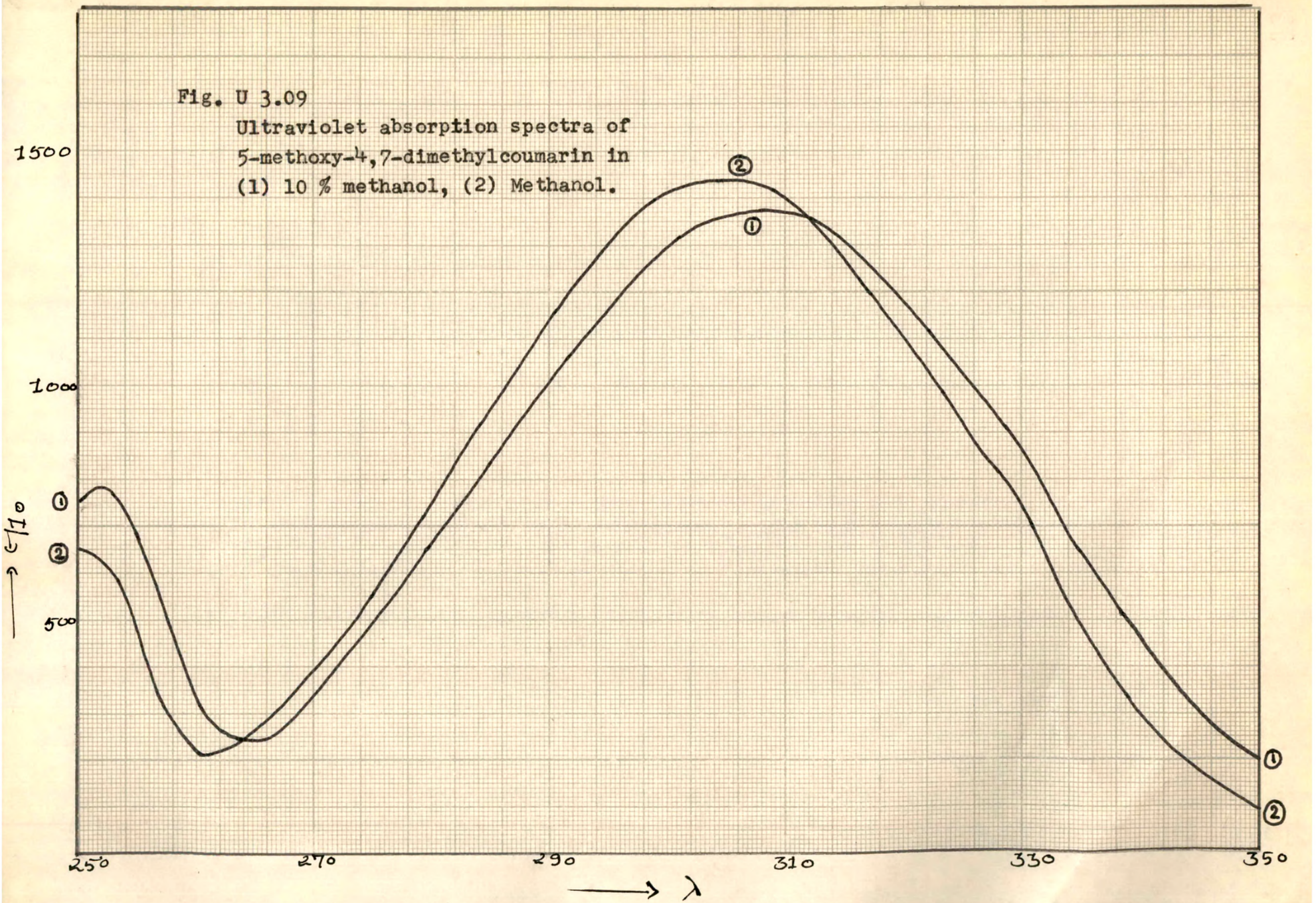


Fig. U 3.09
Ultraviolet absorption spectra of
5-methoxy-4,7-dimethylcoumarin in
(1) 10 % methanol, (2) Methanol.

Table U 3.09

Ultraviolet absorption spectra of 5-hydroxy-4,7-dimethylcoumarin and 5-methoxy-4,7-dimethylcoumarin in 10 % methanol and methanol.

Compound	5-OH-4,7-diMeI		5-MeO-4,7-diMeI	
% methanol	10	100	10	100
λ(mμ)	ϵ/10		ϵ/10	
250	906	768	773	657
52	942	792	787	639
54	950	810	735	532
56	878	736	596	382
58	720	572	428	278
60	566	414	307	226
62	452	316	252	226
64	408	286	243	249
66	410	300	268	263
68	442	340	298	341
72	526	454	399	469
76	636	592	518	611
80	750	760	657	778
84	876	914	807	952
88	1003	1062	958	1103
92	1139	1202	1073	1238
96	1243	1304	1227	1354
98	1280	1346	1271	1389
300	1310	1360	1318	1415
02	1339	1364	1348	1429
04	1346	1364	1366	1432
06	1346	1358	1374	1432
08	1337	1341	1377	1412
10	1327	1304	1377	1398
12	1312	1262	1357	1357
14	1284	1196	1328	1302
16	1182	1130	1284	1229
18	1116	1056	1221	1163
20	1056	986	1169	1074
24	-	-	1047	937
25	890	832	-	-
28	-	-	917	804
30	706	676	839	778
35	512	510	-	-
36	-	-	599	428
40	366	356	451	284
44	-	-	333	288
350	-	-	205	84

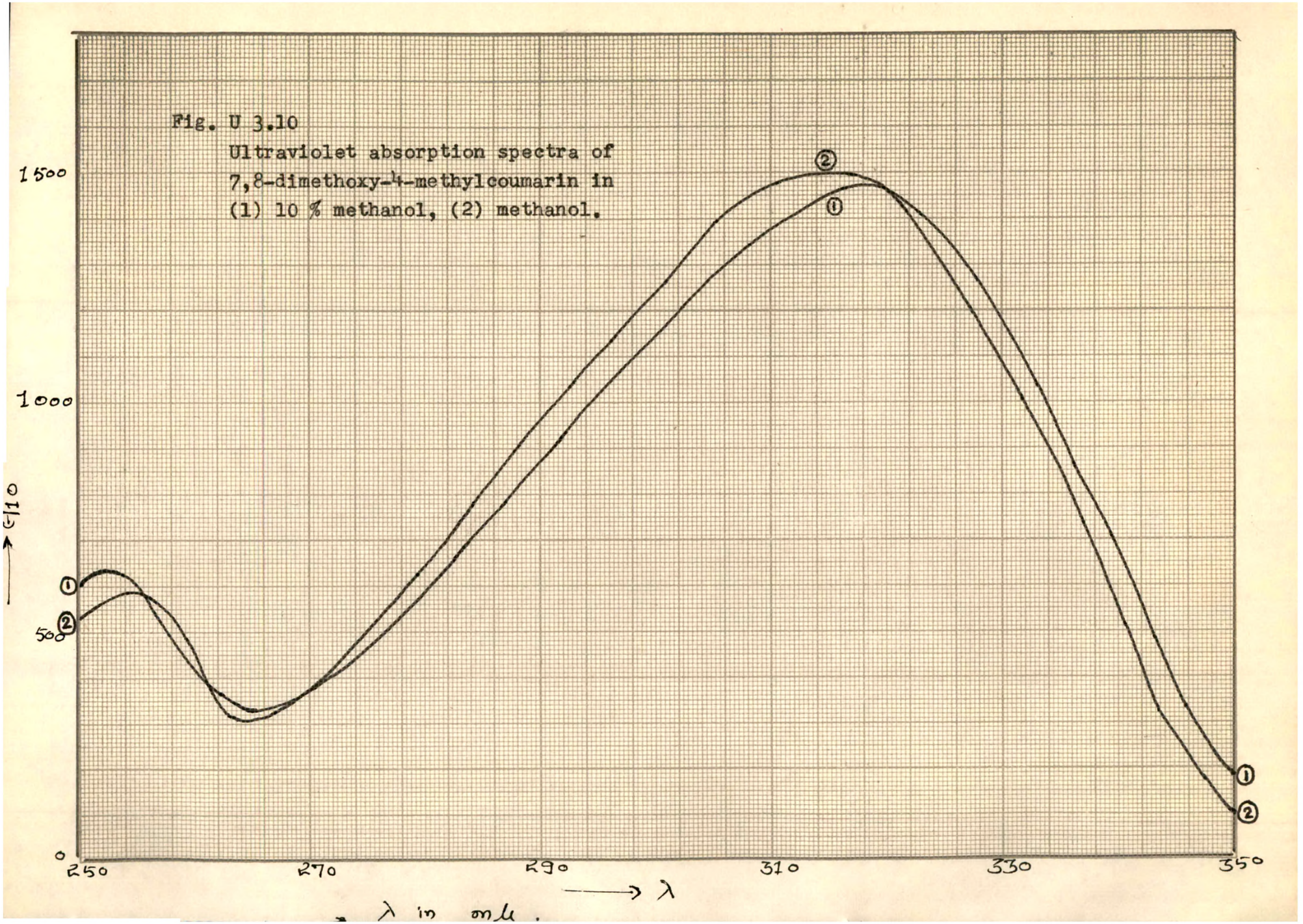


Fig. U 3.10
Ultraviolet absorption spectra of
7,8-dimethoxy-4-methylcoumarin in
(1) 10 % methanol, (2) methanol.

Table U 3.10

Ultraviolet absorption spectra of 7,8-dihydroxy-4-methylcoumarin and 7,8-dimethoxy-4-methylcoumarin in 10 % methanol and methanol.

Compound	7,8-diOH-4-MeI		7,8-diMeO-4-MeI	
% methanol	10	100	10	100
λ(mμ)	ϵ/10		ϵ/10	
250	637	638	624	551
52	684	710	634	576
54	722	784	634	594
56	770	833	584	588
58	789	868	514	529
60	789	897	428	440
62	732	898	366	336
64	656	862	342	329
66	-	745	336	320
68	447	586	353	342
70	-	442	382	379
72	376	361	418	428
76	394	342	511	545
80	451	389	610	665
84	504	462	714	796
88	566	543	822	927
92	633	631	936	1053
96	713	731	1047	1167
300	808	831	1161	1283
04	903	-	1275	1382
08	970	-	1361	1422
10	-	1080	1398	1474
12	1040	-	1422	1490
14	-	-	1450	1505
16	1083	-	1466	1505
18	1113	-	1478	1505
20	1121	1207	1460	1503
22	1121	-	1422	1419
24	1093	-	1373	1342
26	1064	-	1305	1222
28	1027	-	1234	1170
30	998	1111	1154	1083
34	951	-	992	908
38	-	-	788	674
40	713	840	662	542
44	570	-	422	305
350	376	430	172	102

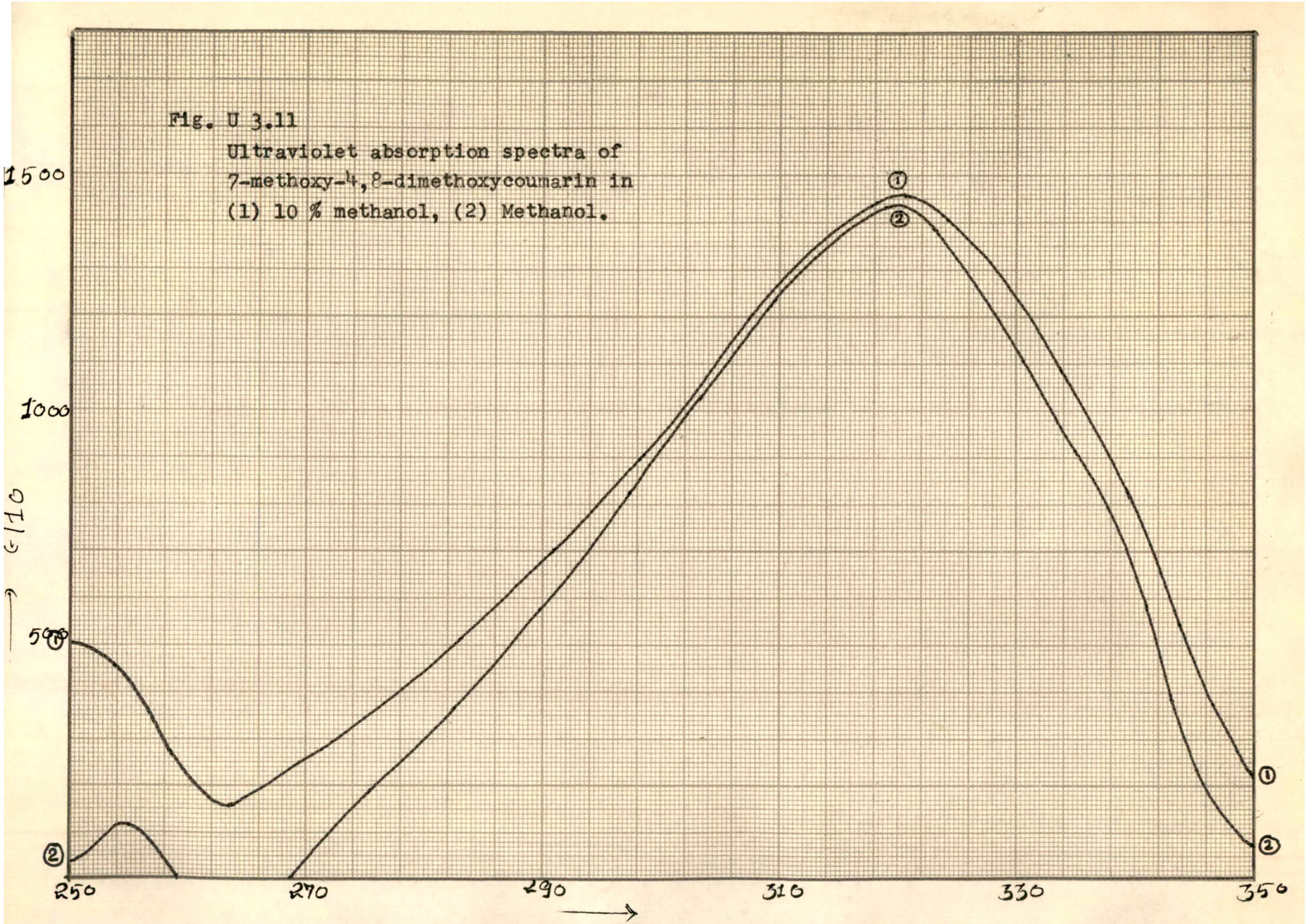


Fig. U 3.11
Ultraviolet absorption spectra of
7-methoxy-4,8-dimethoxycoumarin in
(1) 10 % methanol, (2) Methanol.

Table U 3.11

Ultraviolet absorption spectra of 7-hydroxy-4,8-dimethylcoumarin and 7-methoxy-4,8-dimethylcoumarin in 10 % methanol and methanol.

Compound :	7-OH-4,8-diMeI		7-MeO-4,8-diMeI	
% methanol	10	100	10	100
λ(mμ)	ε/10		ε/10	
250	418	378	436	35
52	422	378	452	67
54	418	387	456	118
56	387	406	401	105
60	244	310	-	-
62	211	249	163	-
66	225	230	194	-
70	277	286	252	48
74	-	-	328	172
75	354	359	-	-
78	-	-	408	242
80	432	443	-	-
82	-	-	509	354
85	525	530	-	-
86	-	-	586	475
90	624	633	685	599
94	-	-	791	710
95	732	746	-	-
98	-	-	902	860
300	854	863	-	-
02	-	-	1027	991
05	985	1009	-	-
06	-	-	1157	1138
10	1121	1157	1272	1259
12	-	-	1326	1303
14	-	-	1371	1352
15	1239	1295	-	-
18	1295	1349	1447	1428
20	1314	1398	1460	1444
22	1327	1419	1453	1424
24	1318	1427	1428	1368
26	1285	1403	1371	1291
28	1252	1356	1313	1205
30	1201	1293	1243	1121
34	-	-	1106	978
35	1060	1131	-	-
38	-	-	927	781
40	873	943	-	-
42	-	-	678	491
45	619	638	-	-
350	366	347	220	83

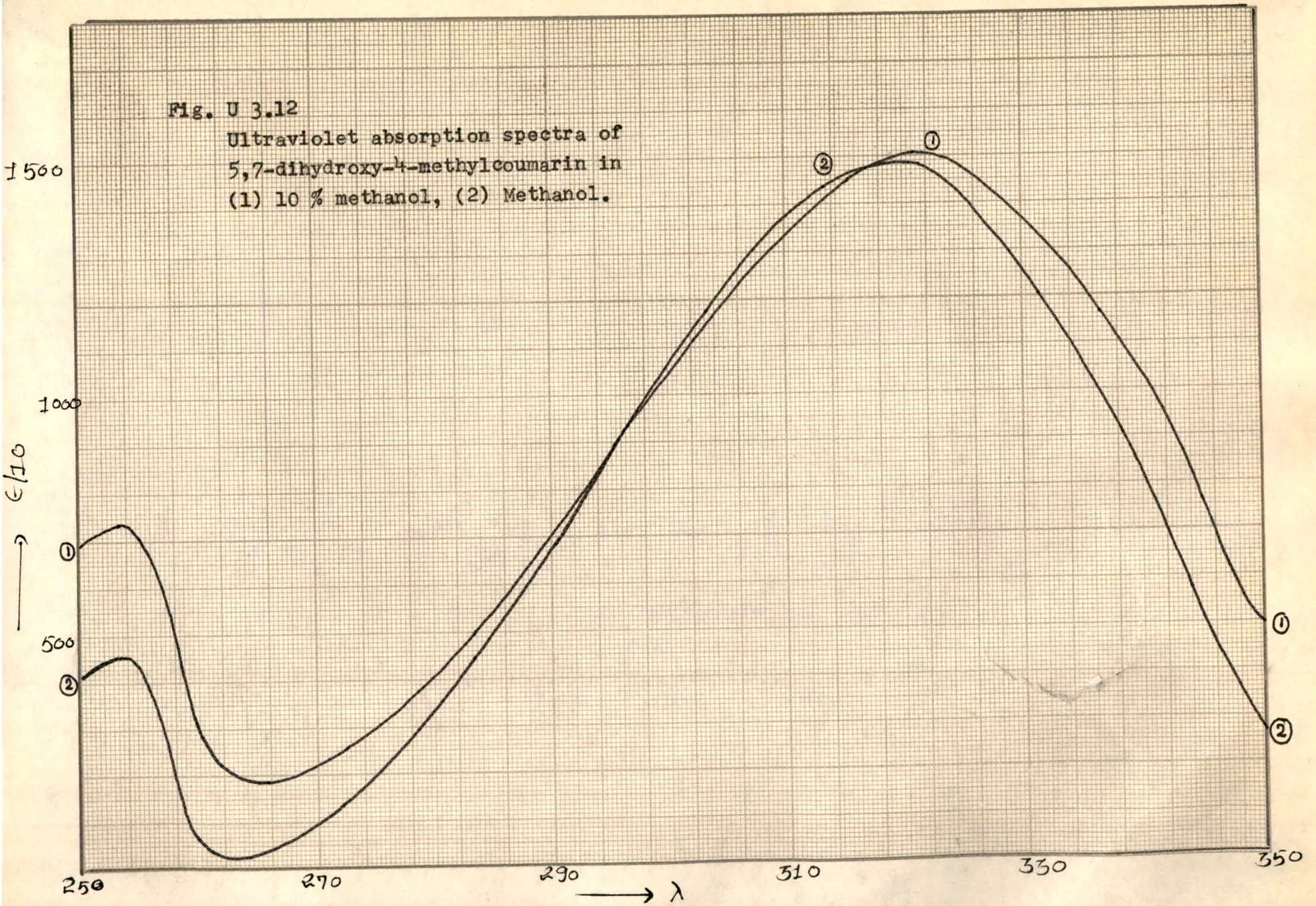


Fig. U 3.12
Ultraviolet absorption spectra of
5,7-dihydroxy-4-methylcoumarin in
(1) 10 % methanol, (2) Methanol.

Table U 3.12

Ultraviolet absorption spectra of 5,7-dihydroxy-4-methylcoumarin and 5,7-dimethoxy-4-methylcoumarin in 10 % methanol and methanol.

Compound :	5,7-diOH-4-MeI		5,7-diMeO-4-MeI	
% methanol	10	100	10	100
λ(mμ)	ε/10		ε/10	
250	555	619	706	422
52	562	626	727	449
54	577	632	743	465
56	595	656	684	380
58	549	656	519	209
60	421	582	326	75
62	278	435	219	32
64	-	-	193	37
66	146	271	193	48
70	161	271	224	101
74	198	302	283	176
78	253	339	363	283
82	320	397	465	396
86	376	476	578	529
90	408	575	706	679
94	615	687	834	829
98	729	802	984	979
302	839	916	1112	1133
06	913	1016	1232	1267
10	1026	1109	1348	1374
14	1090	1181	1432	1444
18	1132	1231	1486	1486
20	1140	1242	1503	1491
22	1136	1249	1503	1481
24	1127	1249	1491	1438
26	1103	1231	1460	1385
28	1086	1209	-	-
30	1055	1181	1379	1251
34	967	1109	1267	1113
38	-	-	1118	936
40	793	949	-	-
42	-	-	930	711
45	610	685	-	-
46	-	-	716	460
350	430	540	503	261

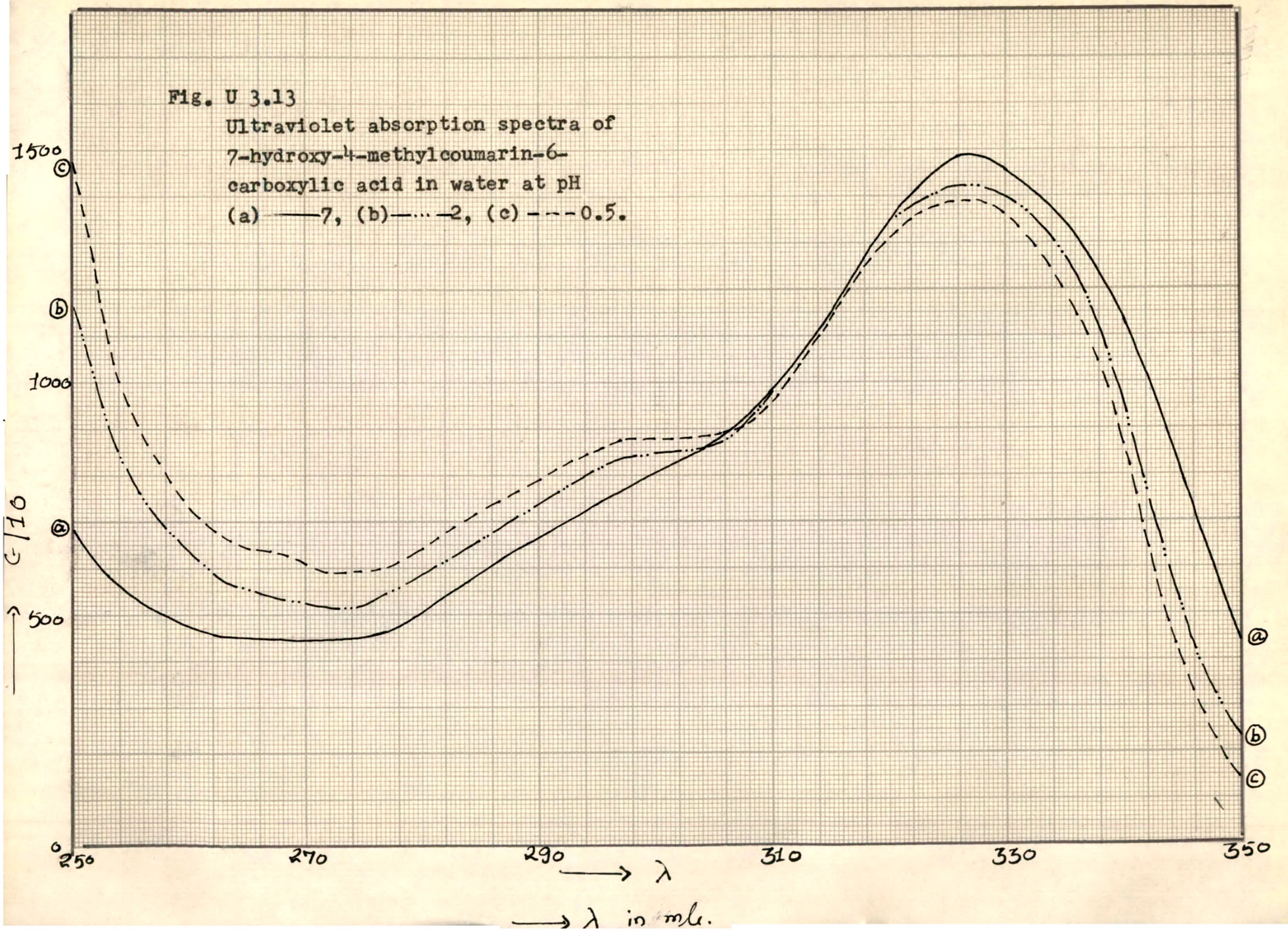


Fig. U 3.13
Ultraviolet absorption spectra of 7-hydroxy-4-methylcoumarin-6-carboxylic acid in water at pH (a) ——7, (b)—·—2, (c) - - - 0.5.

Table U 3.13

Ultraviolet absorption spectra of 7-hydroxy-4-methylcoumarin-6-carboxylic acid in water at different pH.

pH =	7	3	2	1	0.5
λ(mμ)			ε/10		
250	693	765	1169	1403	1475
54	559	600	830	957	1008
58	501	528	683	765	813
60	484	501	641	684	737
62	463	487	597	652	681
64	456	480	569	618	655
66	456	473	559	600	641
68	449	473	545	586	628
70	449	463	535	576	607
72	442	460	528	566	593
74	449	460	525	562	593
76	459	473	535	566	597
78	477	490	559	583	614
80	508	518	580	614	641
84	576	590	652	686	706
88	638	652	710	741	765
92	696	710	779	796	813
94	724	744	803	823	837
96	758	782	827	841	861
98	789	799	844	861	871
300	813	820	851	868	878
02	834	837	854	864	878
04	847	857	864	868	871
06	881	888	888	873	892
08	930	933	919	906	909
10	991	991	988	954	942
12	1060	1056	1026	1012	1019
14	1121	1132	1101	1087	1091
16	1200	1241	1187	1155	1153
18	1273	1276	1266	1238	1252
20	1352	1358	1300	1310	1290
22	1414	1420	1386	1358	1355
24	1461	1457	1409	1376	1379
26	1489	1489	1423	1376	1386
28	1489	1489	1420	1372	1386
30	1461	1468	1403	1369	1369
34	1386	1400	1327	1273	1307
38	1259	1248	1126	1048	1067
42	1042	1008	792	665	672
46	751	710	677	350	336
350	494	453	264	154	151

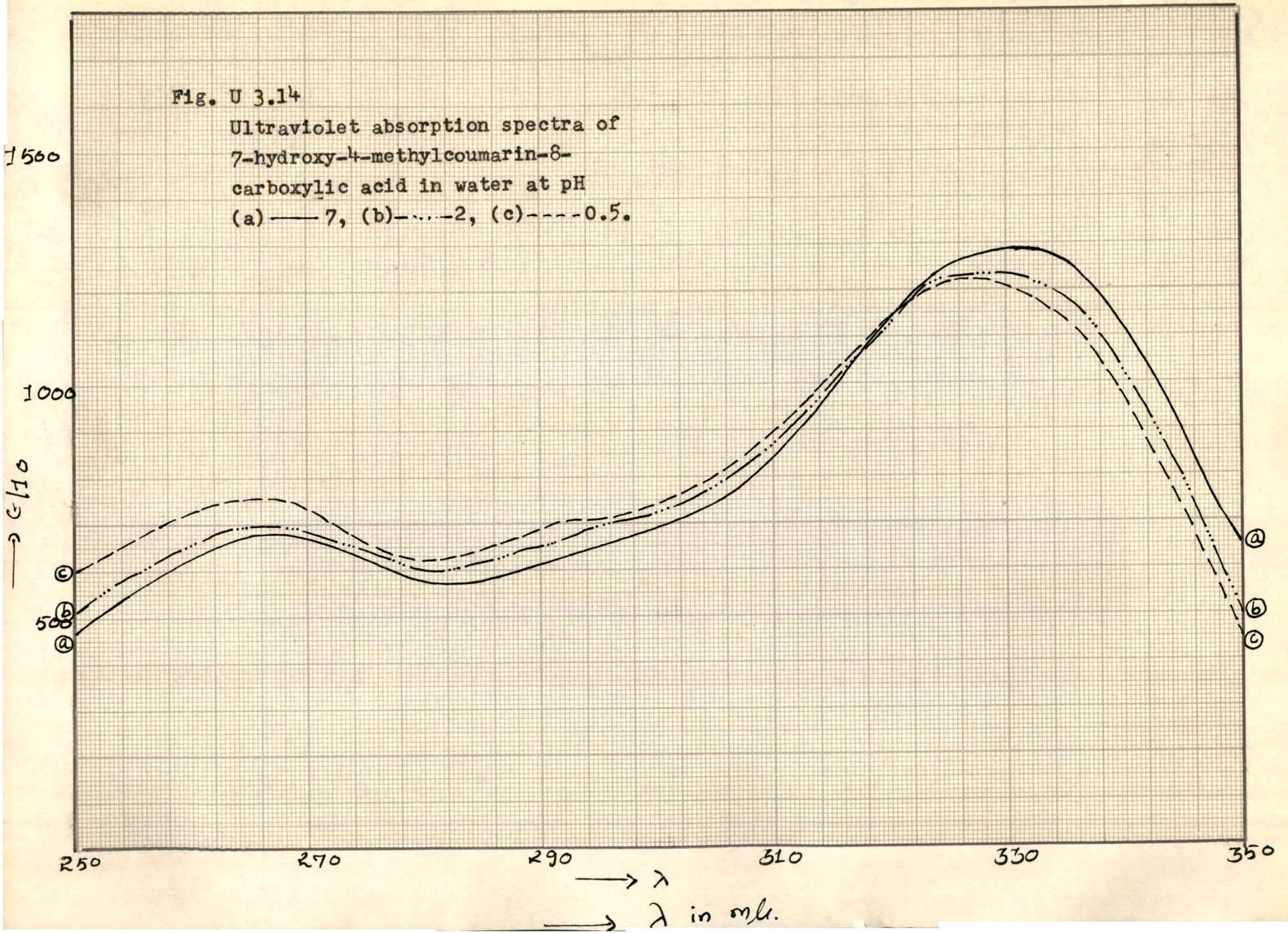


Fig. U 3.14
Ultraviolet absorption spectra of 7-hydroxy-4-methylcoumarin-8-carboxylic acid in water at pH (a) —— 7, (b) -·-·- 2, (c) - - - - 0.5.

Table U 3.14

Ultraviolet absorption spectra of 7-hydroxy-4-methylcoumarin-8-carboxylic acid in water at different pH.

pH =	7	4	2	1	0.5
λ(mμ)			ε/10		
250	475	463	516	555	608
54	549	533	580	624	658
58	602	594	638	680	710
60	624	616	661	705	736
62	644	633	677	727	749
64	666	649	688	730	758
66	680	661	699	730	758
68	677	658	691	722	758
70	666	652	685	706	730
72	652	644	666	698	702
74	641	630	658	652	677
76	622	613	635	624	641
78	599	594	622	612	624
80	583	577	608	612	630
82	583	577	608	616	635
84	583	586	622	622	641
86	594	586	627	638	663
88	599	599	641	652	674
90	611	616	655	681	691
92	624	641	672	683	719
94	641	663	697	702	719
96	666	674	702	708	727
98	683	691	713	708	722
300	694	704	733	722	747
02	722	724	747	735	763
04	744	752	769	755	788
06	769	774	802	791	824
08	797	816	833	827	860
10	860	860	877	866	899
12	896	905	924	913	944
14	966	966	977	957	994
16	1013	1013	1032	1019	1046
18	1079	1091	1085	1065	1099
20	1144	1144	1147	1113	1147
22	1193	1204	1191	1149	1188
24	1224	1235	1210	1169	1207
26	1266	1266	1232	1188	1221
28	1276	1279	1238	1188	1221
30	1282	1282	1227	1169	1210
32	1282	1282	1224	1149	1191
34	1279	1279	1207	1113	1165
36	1254	1251	1171	1082	1124
38	1207	1199	1121	1013	1068
40	1138	1135	1038	957	980
44	952	960	852	768	791
48	749	733	619	541	561
350	666	641	519	433	452

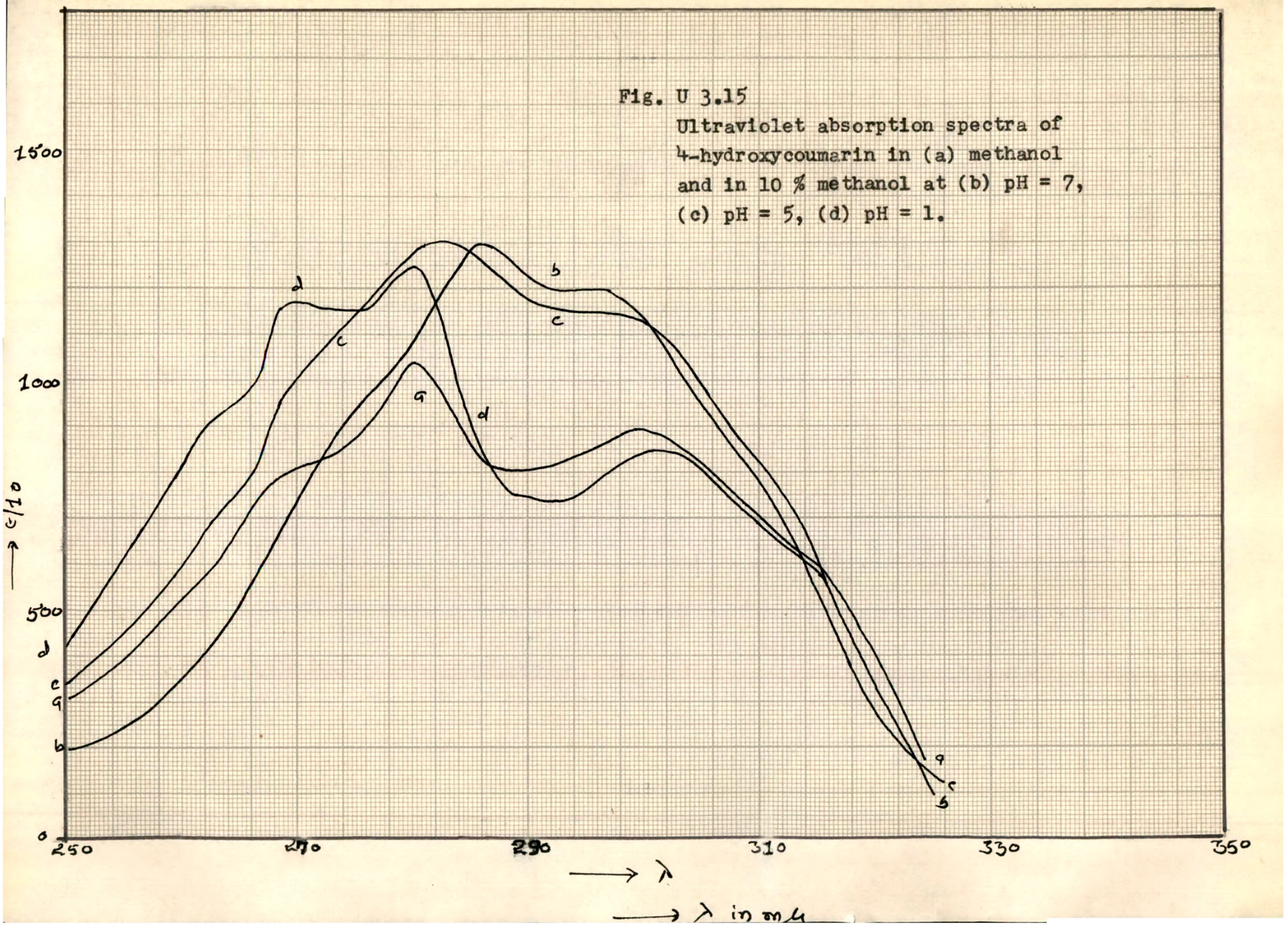


Fig. U 3.15
Ultraviolet absorption spectra of 4-hydroxycoumarin in (a) methanol and in 10 % methanol at (b) pH = 7, (c) pH = 5, (d) pH = 1.

Table U 3.15

Ultraviolet absorption spectra of 4-hydroxycoumarin in methanol and 10 % methanol of different pH.

M = methanol ; TM = 10 % methanol

Solvent:	M	TM					
pH =	-	7	6	5	4	3	1
λ(mμ)				ε/10			
250	319	206	223	347	391	429	428
56	424	272	308	487	596	671	670
60	520	367	420	606	736	821	821
62	575	-	485	680	821	904	902
66	736	555	559	764	895	969	967
68	787	635	718	932	1100	1156	1156
70	817	742	821	1016	1119	1174	1174
72	818	827	914	1063	1128	1156	1156
74	847	908	1007	1134	1128	1156	1156
76	908	968	1081	1174	1156	1156	1156
78	988	1019	1137	1230	1203	1212	1212
80	1043	1080	1193	1286	1230	1250	1250
82	918	1174	1286	1305	1184	1165	1165
84	918	1251	1380	1305	1063	998	995
86	827	1302	1417	1268	951	848	846
88	817	1271	1395	1212	876	764	764
90	817	1221	1333	1174	848	755	755
92	818	1200	1305	1156	839	746	746
94	843	1200	1295	1156	857	745	745
96	857	1200	1295	1156	876	792	792
98	878	1180	1277	1156	904	811	811
300	898	1150	1250	1137	913	848	848
04	-	988	1063	1025	857	830	830
10	696	797	839	821	699	680	680
15	595	544	550	596	587	596	596
20	403	278	255	317	326	336	336
325	141	141	84	102	93	102	102

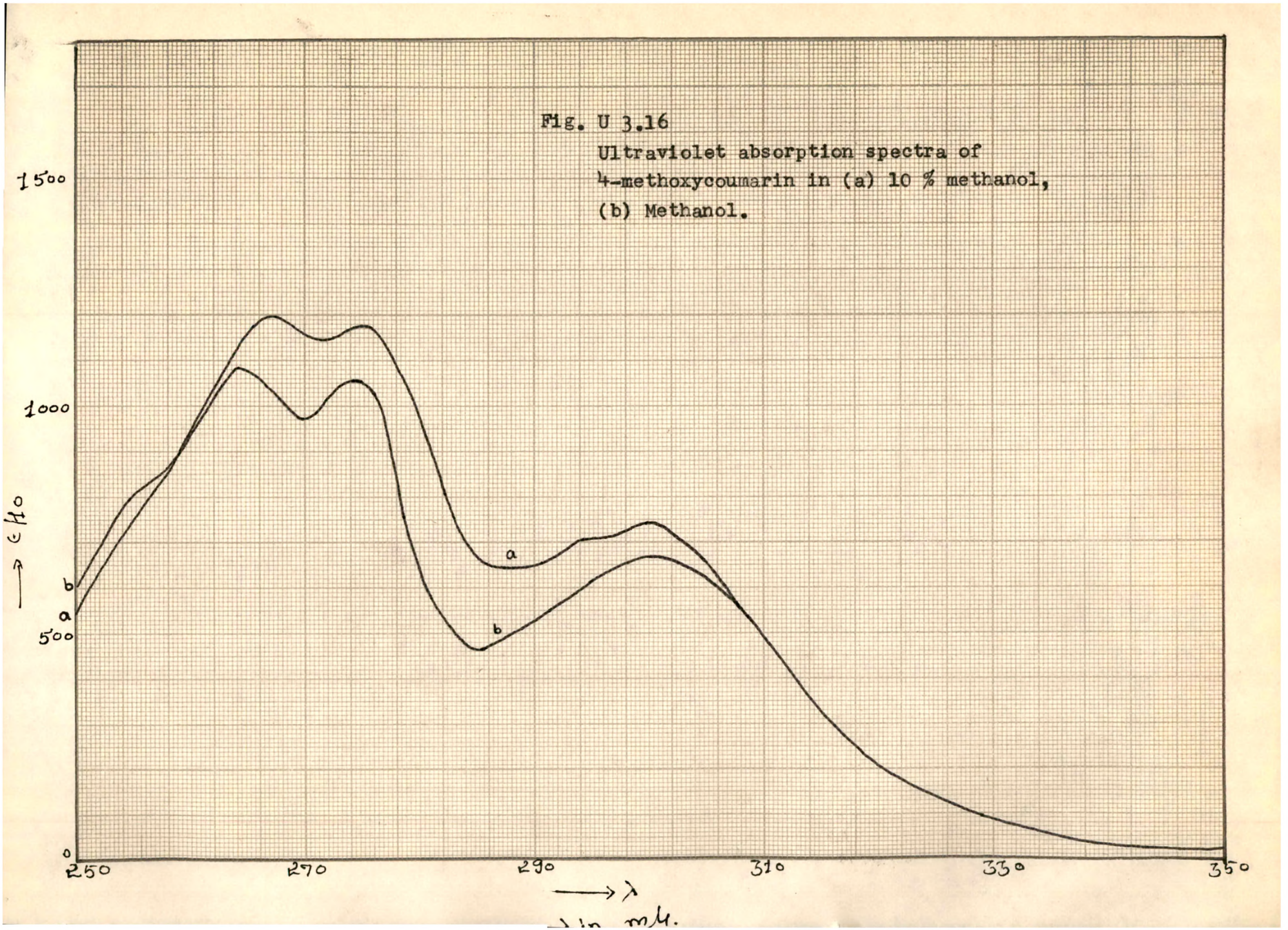


Fig. U 3.16
Ultraviolet absorption spectra of
4-methoxycoumarin in (a) 10 % methanol,
(b) Methanol.

Table U 3.16

Ultraviolet absorption spectra of 4-methoxycoumarin in 10 % methanol and methanol.

% methanol	10	100
λ(mμ)	ϵ/10	
250	553	609
52	643	692
54	722	771
56	779	779
58	869	855
60	948	920
62	1049	1029
64	1129	1093
66	1196	1061
68	1196	1016
70	1151	970
72	1151	1011
74	-	1060
76	1173	1038
78	1093	857
80	970	643
84	699	474
86	654	474
90	654	530
94	711	598
96	711	632
98	733	654
300	745	677
05	654	632
10	553	530
20	203	203
25	67	67
40	34	34
350	23	23

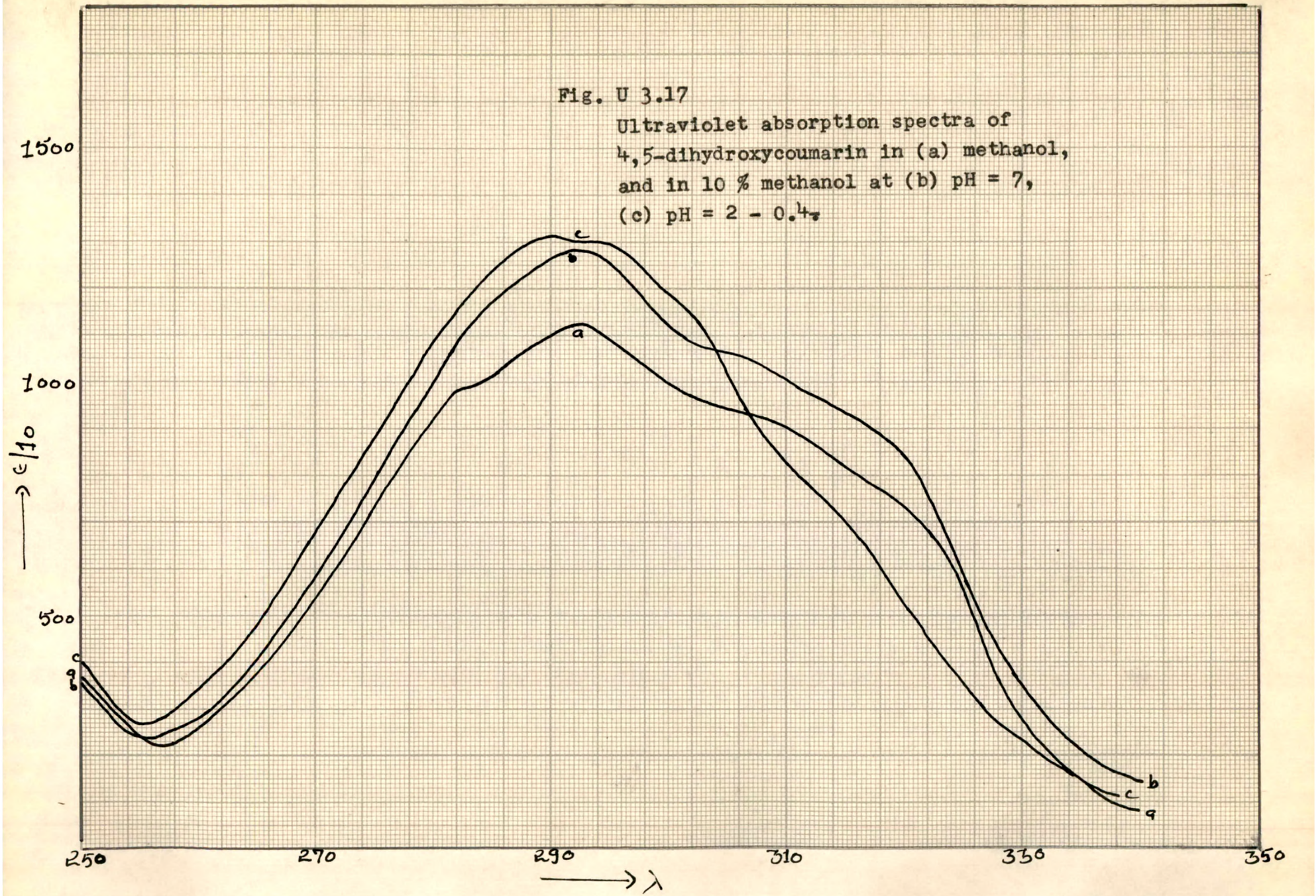


Fig. U 3.17
Ultraviolet absorption spectra of 4,5-dihydroxycoumarin in (a) methanol, and in 10 % methanol at (b) pH = 7, (c) pH = 2 - 0.4.

Table U 3.17

Ultraviolet absorption spectra of 4,5-dihydroxycoumarin in methanol and 10 % methanol of different pH.

M = methanol ; TM = 10 % methanol

Solvent :	M	TM				
pH =	-	7	3	2	1	0.4
λ(mμ)				ε/10		
250	371	363	321	402	399	424
52	300	293	287	314	317	317
54	270	250	253	274	283	286
56	235	247	247	277	286	280
58	245	262	265	308	317	313
62	308	314	338	396	411	408
66	418	430	460	515	527	524
70	541	576	607	670	686	689
74	696	744	774	835	862	850
78	842	927	942	1002	1039	1018
82	980	1088	1091	1155	1177	1170
84	1007	1143	1155	1214	1234	1234
86	1042	1182	1200	1262	1280	1283
88	1074	1231	1237	1298	1311	1311
90	1105	1262	1259	1311	1323	1317
92	1125	1280	1277	1304	1323	1317
94	1115	1275	1256	1301	1317	1317
96	1079	1231	1226	1292	1308	1314
98	1036	1170	1185	1275	1301	1295
300	999	1109	1133	1219	1247	1247
02	976	1088	1084	1147	1158	1164
04	959	1073	1040	1054	1070	1060
06	949	1060	987	969	969	969
08	931	1036	945	896	896	896
10	906	1006	905	847	841	844
12	870	972	854	802	795	789
14	832	954	820	747	743	752
16	807	920	783	695	683	683
18	782	890	712	622	603	600
20	742	838	665	536	524	515
22	686	756	600	478	454	454
24	603	658	494	393	370	375
26	492	539	402	329	329	326
28	374	398	338	286	289	277
30	283	359	268	244	256	235
32	212	277	210	204	204	192
34	161	235	174	177	174	165
36	126	189	131	137	140	134
38	93	165	113	116	113	116
340	81	146	88	88	97	88

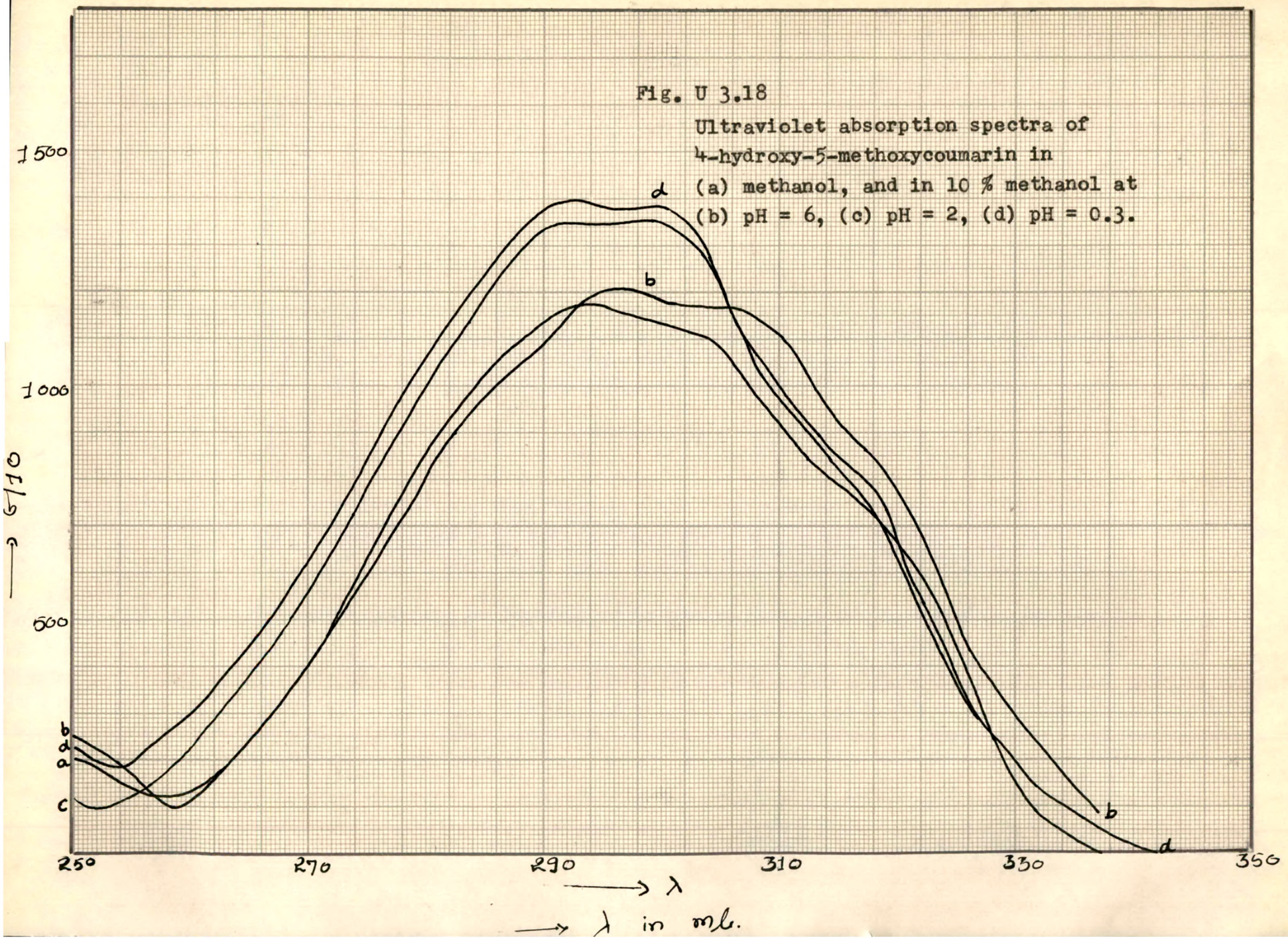


Fig. U 3.18

Ultraviolet absorption spectra of 4-hydroxy-5-methoxycoumarin in (a) methanol, and in 10 % methanol at (b) pH = 6, (c) pH = 2, (d) pH = 0.3.

Table U 3.18

Ultraviolet absorption spectra of 4-hydroxy-5-methoxycoumarin in methanol and 10 % methanol of different pH.

M = methanol ; TM = 10 % methanol.

Solvent :	M	TM				
pH =	-	6	4	2	1	0.3
λ(mμ)				ε/10		
250	204	255	226	122	186	226
52	180	233	198	100	170	198
54	169	182	198	116	182	210
56	143	132	214	145	201	239
58	122	100	239	186	242	264
60	130	119	280	229	279	308
64	214	213	387	352	396	428
68	334	334	516	487	531	557
72	469	494	682	642	689	720
76	674	642	862	827	874	893
80	869	815	1019	1000	1044	1063
84	1003	950	1182	1157	1192	1211
88	1102	1059	1305	1308	1320	1349
90	1144	1114	1340	1340	1371	1384
92	1162	1153	1358	1349	1380	1396
94	1170	1185	1365	1349	1377	1396
96	1162	1201	1365	1349	1377	1384
98	1152	1201	1365	1349	1377	1384
300	1141	1185	1355	1349	1365	1384
02	1128	1185	1334	1321	1346	1365
04	1109	1176	1271	1261	1283	1292
06	1059	1176	1176	1167	1176	1198
08	988	1148	1076	1047	1073	1085
10	916	1110	1000	962	972	987
12	853	1047	930	893	909	934
14	824	950	881	852	859	877
16	763	915	839	796	814	830
18	726	862	780	748	764	786
20	673	789	686	654	669	682
22	645	686	576	528	532	563
24	458	588	449	412	437	447
26	349	443	358	320	336	358
28	246	305	264	252	264	273
30	159	182	195	195	207	206
332	123	104	154	138	157	182

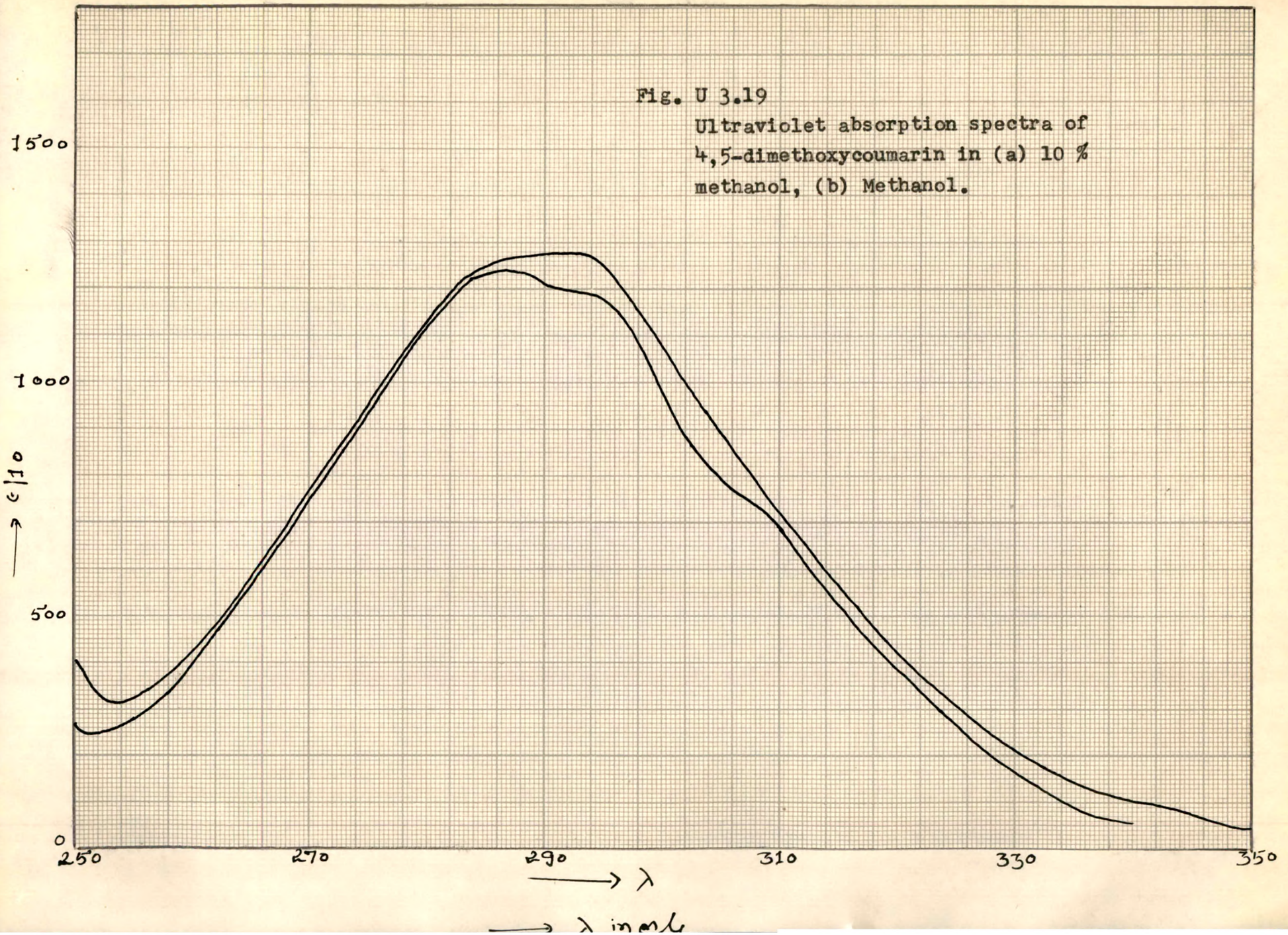


Fig. U 3.19
Ultraviolet absorption spectra of 4,5-dimethoxycoumarin in (a) 10 % methanol, (b) Methanol.

Table U 3.19

Ultraviolet absorption spectra of 4,5-dimethoxycoumarin in 10 % methanol and methanol.

% Methanol	10	100
λ(mμ)	ε/10	
250	401	267
52	338	251
54	325	269
56	348	305
58	385	351
60	435	405
64	544	539
68	700	679
72	849	826
76	985	987
80	1124	1134
82	1203	1195
84	1240	1230
86	1267	1233
88	1270	1226
90	1273	1210
92	1276	1208
94	1276	1199
96	1223	1164
98	1167	1087
300	1081	995
02	1001	895
04	946	823
06	872	777
08	809	735
10	769	702
12	668	659
14	627	590
16	547	515
18	487	454
20	428	397
22	378	345
24	338	300
26	302	251
28	255	205
30	212	174
32	189	128
34	162	103
36	132	84
38	112	69
40	106	51
44	86	-
350	43	-

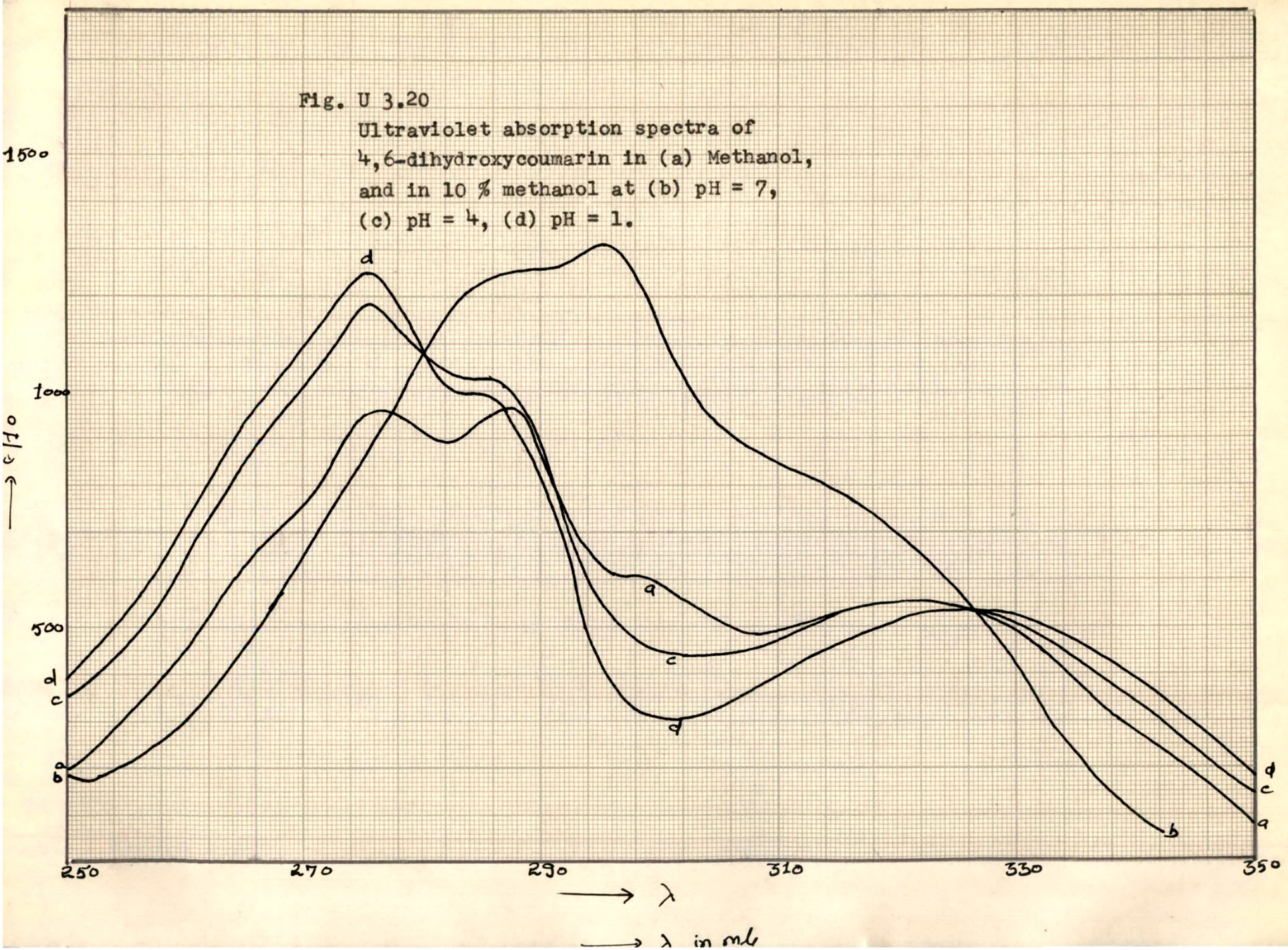


Fig. U 3.20
Ultraviolet absorption spectra of 4,6-dihydroxycoumarin in (a) Methanol, and in 10 % methanol at (b) pH = 7, (c) pH = 4, (d) pH = 1.

Table U 3.20

Ultraviolet absorption spectra of 4,6-dihydroxycoumarin in methanol and 10 % methanol of different pH.

M = methanol ; TM = 10 % methanol

Solvent :	M	TM				
pH =	-	7	4	2	1	0.5
λ(mμ)			ϵ/10			
250	219	187	354	367	398	452
54	287	196	436	462	496	553
58	384	256	566	626	645	702
62	532	351	740	794	825	882
66	661	484	898	942	980	1034
70	757	648	1018	1066	1100	1148
72	832	730	1087	1145	1166	1217
74	918	812	1163	1208	1233	1283
76	963	892	1182	1211	1240	1293
78	952	974	1141	1151	1169	1220
80	914	1081	1072	1050	1072	1126
82	897	1166	1040	980	1012	1053
84	920	1212	1024	961	993	1037
86	953	1246	1030	961	993	1024
88	978	1255	987	907	929	967
90	876	1255	876	759	790	835
92	751	1277	721	579	607	658
94	663	1302	604	433	455	490
96	618	1309	522	329	354	392
98	608	1252	471	288	313	345
300	592	1157	452	278	304	329
02	564	1047	443	285	306	338
04	530	958	446	297	326	354
06	502	904	449	326	348	376
08	491	860	465	348	376	402
10	493	844	477	376	398	421
12	506	825	503	401	433	452
14	521	803	515	430	455	480
16	532	771	531	455	474	499
18	547	746	544	474	493	518
20	550	702	550	487	515	544
22	549	655	558	503	531	553
24	545	610	547	512	534	560
26	534	558	540	522	543	565
28	515	500	525	515	531	556
30	489	436	501	496	525	550
34	406	426	443	455	484	503
38	313	149	373	408	433	465
42	238	69	308	335	357	386
46	182	-	218	247	275	297
350	75	-	145	168	186	209

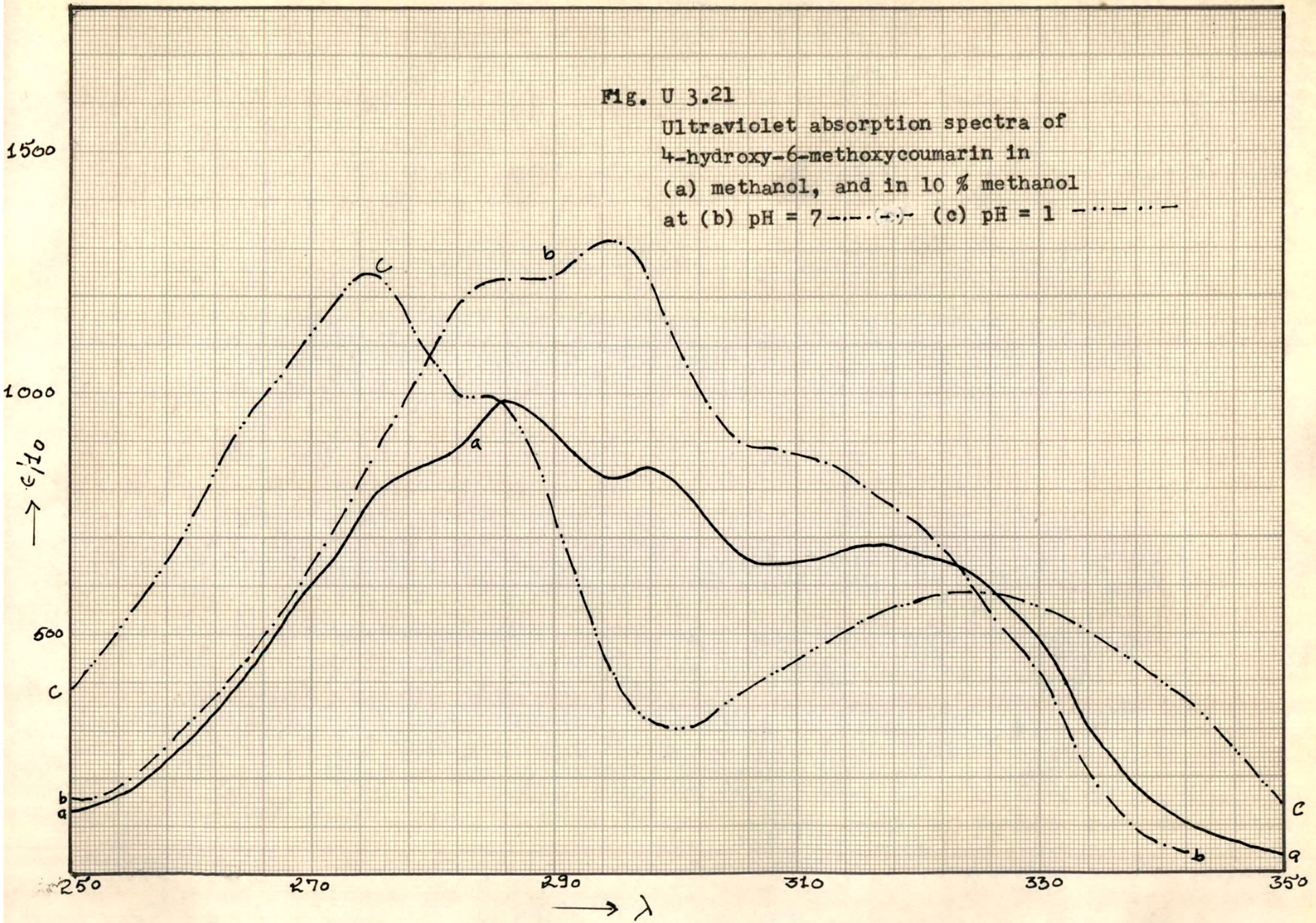


Fig. U 3.21
Ultraviolet absorption spectra of
4-hydroxy-6-methoxycoumarin in
(a) methanol, and in 10 % methanol
at (b) pH = 7 —·—·—·— (c) pH = 1 —··—··—

Table U 3.21

Ultraviolet absorption spectra of 4-hydroxy-6-methoxycoumarin in methanol and 10 % methanol of different pH.

M = methanol ; TM = 10 % methanol

Solvent :	M	TM			
pH =	-	7	3	2.6	1
λ(mμ)			ε/10		
250	137	166	376	387	394
54	181	173	475	493	508
58	262	239	622	655	659
62	384	346	818	843	843
66	490	482	968	1002	1002
70	608	648	1090	1123	1123
72	705	744	1170	1200	1193
74	771	821	1229	1263	1267
76	811	906	1218	1245	1248
78	833	990	1153	1168	1168
80	855	1093	1057	1068	1068
82	905	1174	1009	1016	1009
84	961	1226	1002	1006	998
86	998	1233	990	990	994
88	974	1241	928	928	928
90	911	1248	762	762	751
92	852	1285	586	580	574
94	836	1314	449	468	468
96	849	1314	376	346	346
98	855	1248	354	309	317
300	824	1119	346	317	317
02	761	1028	376	331	306
04	702	920	376	357	357
06	665	898	398	390	383
08	652	884	427	412	412
10	659	869	456	453	445
12	674	860	485	471	475
14	685	836	504	501	504
16	684	803	530	527	526
18	677	759	549	545	545
20	661	699	562	567	567
22	643	674	578	578	578
24	621	619	578	582	585
26	599	549	574	582	585
28	555	493	563	567	567
30	490	409	541	552	556
34	306	217	479	501	504
38	178	88	416	438	435
42	119	44	335	341	361
46	72	-	232	254	254
350	25	-	114	151	169

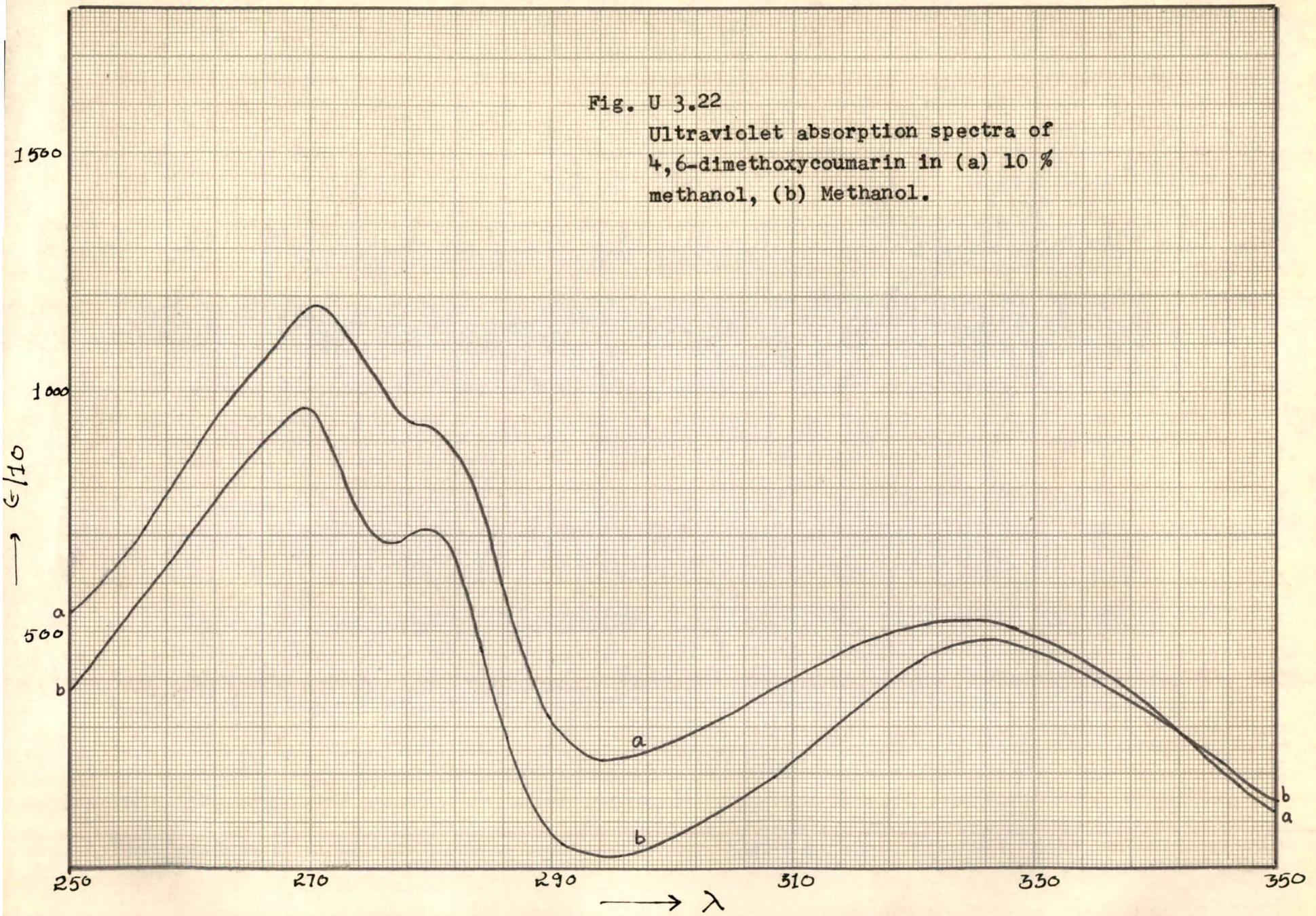


Fig. U 3.22
Ultraviolet absorption spectra of 4,6-dimethoxycoumarin in (a) 10 % methanol, (b) Methanol.

Table U 3.22

Ultraviolet absorption spectra of 4,6-dimethoxycoumarin in 10 % methanol and methanol.

% methanol	10	100
λ (mμ)	ε/10	
250	547	384
52	581	440
54	636	508
56	710	597
58	789	693
60	884	758
62	942	780
64	996	811
66	1064	882
68	1135	959
70	1187	972
72	1169	875
74	1086	749
76	999	693
78	945	703
80	932	718
82	897	672
84	792	508
86	619	309
88	445	158
90	323	77
92	262	40
94	231	31
96	238	37
98	248	53
300	270	74
04	320	121
08	377	180
12	428	257
16	483	346
18	499	393
20	517	437
22	524	458
24	524	477
26	524	489
28	507	477
30	490	470
34	432	417
38	377	365
42	292	300
46	197	201
350	122	69

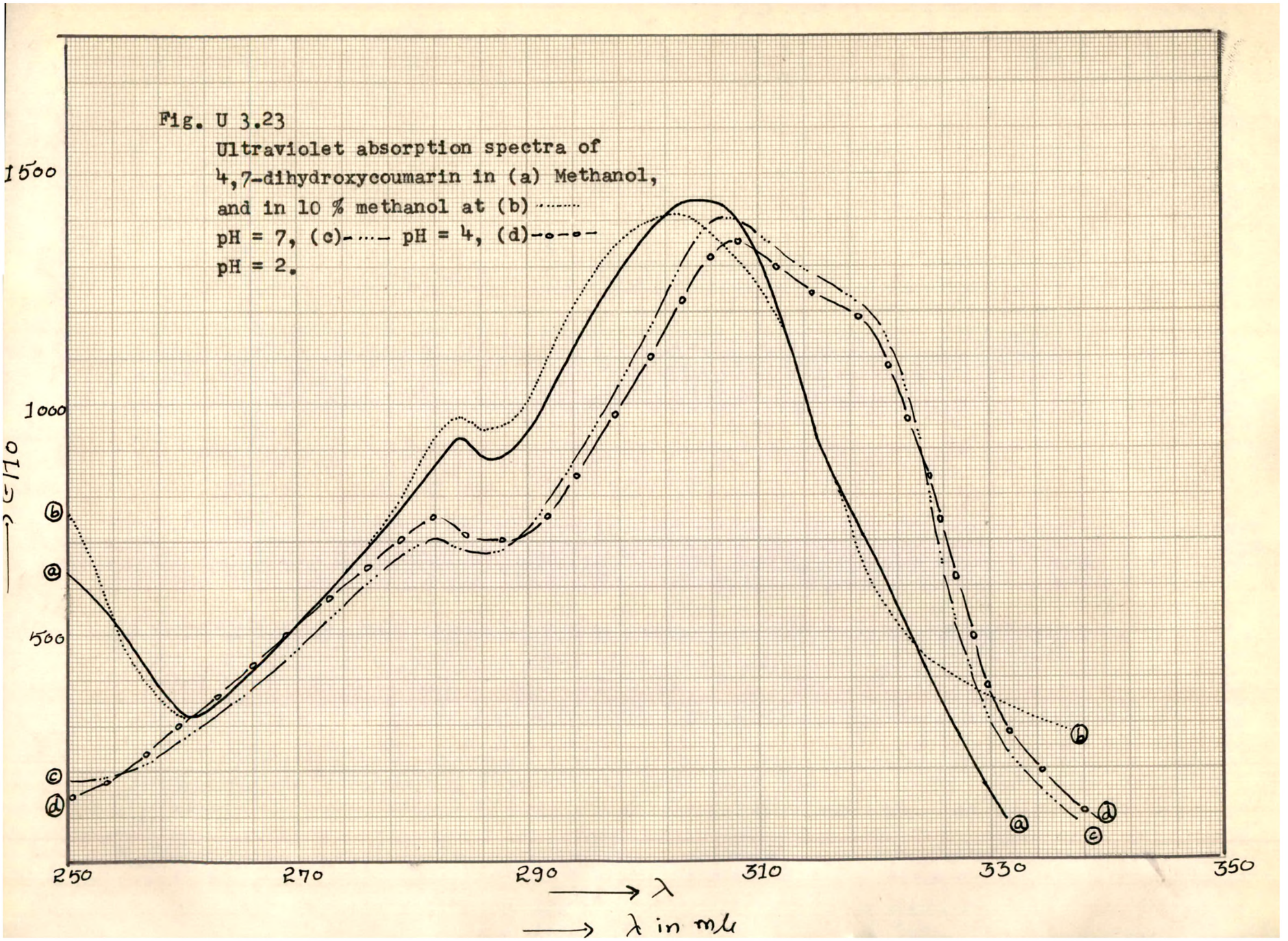


Fig. U 3.23
Ultraviolet absorption spectra of 4,7-dihydroxycoumarin in (a) Methanol, and in 10 % methanol at (b) ····· pH = 7, (c)-·····- pH = 4, (d)-o-o- pH = 2.

Table U 3.23

Ultraviolet absorption spectra of 4,7-dihydroxycoumarin in methanol and 10 % methanol of different pH.

M = methanol ; TM = 10 % methanol.

Solvent :	M	TM					
pH =	-	7	6	5	4	3	2
λ(mμ)				ϵ/10			
250	646	776	708	398	185	178	150
55	494	460	440	286	204	222	204
60	328	328	346	276	271	301	319
65	403	386	413	354	360	394	402
70	520	526	571	483	470	521	523
75	-	655	699	598	564	613	622
80	802	848	860	739	687	725	729
82	880	935	946	797	708	742	753
84	933	975	970	805	697	723	737
86	896	943	941	773	676	696	708
88	888	956	946	784	680	699	708
90	939	1007	991	837	727	729	734
92	1023	1164	1067	948	855	788	793
94	1122	1212	1137	1023	906	868	858
96	1218	1286	1227	1098	998	926	938
98	1302	1354	1292	1154	1026	1000	1005
300	1377	1394	1341	1246	1128	1083	1077
02	1429	1413	1368	1314	1227	1170	1167
04	1448	1413	1356	1371	1318	1259	1247
06	1441	1378	1335	1392	1390	1329	1326
08	1420	1329	1274	1378	1405	1359	1351
10	1340	1265	1209	1325	1378	1325	1329
15	905	966	906	1132	1287	1246	1247
20	674	579	493	875	1202	1151	1174
25	386	432	255	532	786	788	804
30	150	381	161	204	314	341	362
335	-	303	70	72	98	121	134

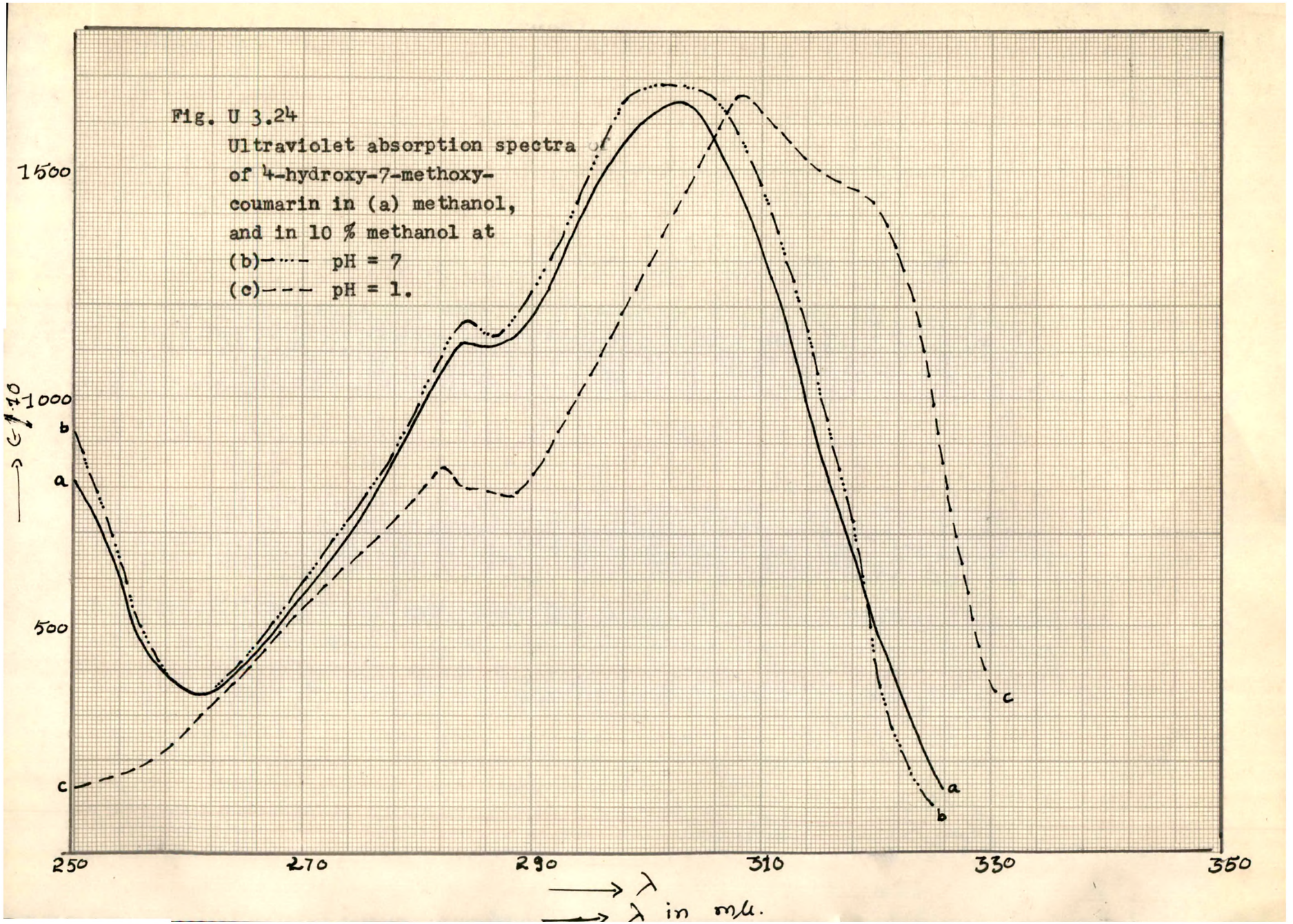


Fig. U 3.24
Ultraviolet absorption spectra of of 4-hydroxy-7-methoxy-coumarin in (a) methanol, and in 10 % methanol at
(b)—·····— pH = 7
(c)— — — pH = 1.

Table U 3.24

Ultraviolet absorption spectra of 4-hydroxy-7-methoxycoumarin in methanol and 10 methanol of different pH.

M = methanol ; TM = 10 % methanol

Solvent :	M	TM					
pH =	-	7	6	4	3	2	1
λ(mμ)				ε/10			
252	818	929	968	950	191	158	143
56	454	485	508	506	220	209	198
60	354	362	363	363	290	290	275
62	354	-	-	-	-	-	317
64	391	386	398	403	374	387	370
66	440	442	-	-	-	-	429
68	501	507	517	-	494	506	488
70	579	593	-	-	-	-	543
72	647	675	682	693	596	616	583
74	699	736	736	741	-	-	616
76	757	779	801	798	675	701	673
78	831	885	891	891	737	781	737
80	928	996	1001	996	805	836	796
82	1056	1110	1124	1122	851	858	851
84	1124	1177	1175	1177	823	827	803
86	1110	1148	1148	1155	796	792	794
88	1124	1160	1185	1168	805	803	781
90	1184	1230	1258	1238	-	-	836
92	1278	-	1359	1342	941	923	913
94	1380	1447	1474	1451	-	-	1012
96	1490	1468	1583	1562	1133	1100	-
98	1564	1664	1671	1650	-	-	1199
300	1624	1676	1685	1675	1331	1287	-
02	1649	1688	1698	1698	1430	1385	1408
04	1649	1682	1675	1693	1540	1495	-
06	1563	1677	1650	1627	1617	1583	1606
08	1466	-	1562	1551	1660	1660	1660
10	1356	1471	1451	1430	1627	1583	1627
15	892	1033	1012	1012	1496	1474	1507
20	513	415	418	407	1364	1408	1430
25	183	109	-	-	928	990	1001
330	-	-	-	-	374	409	400

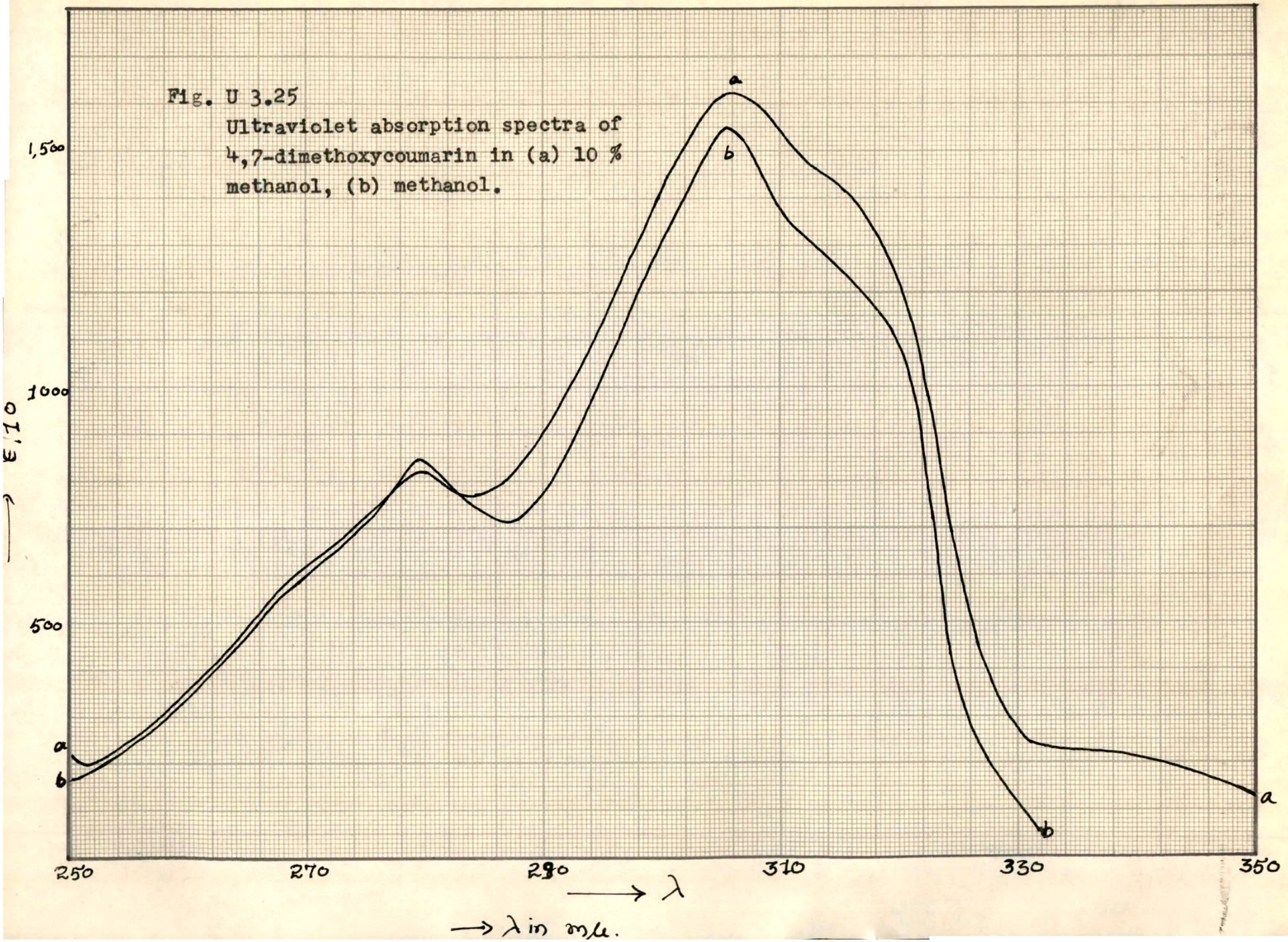


Fig. U 3.25
Ultraviolet absorption spectra of 4,7-dimethoxycoumarin in (a) 10 % methanol, (b) methanol.

Table U 3.25

Ultraviolet absorption spectra of 4,7-dimethoxycoumarin in 10 % methanol and methanol.

% methanol λ (mμ)	10	100
	ϵ/10	
250	217	179
52	209	197
54	236	-
56	268	263
60	363	355
64	474	468
68	583	591
72	651	646
74	705	-
76	762	749
78	813	802
79	821	841
80	827	841
83	792	788
84	773	-
88	827	723
92	992	-
96	1185	-
98	1296	1209
300	1410	-
02	1518	1419
05	1621	1551
06	1627	1551
08	1600	1484
10	1531	1377
15	1440	1261
20	1233	1117
25	637	473
30	217	118
40	217	-
350	136	-

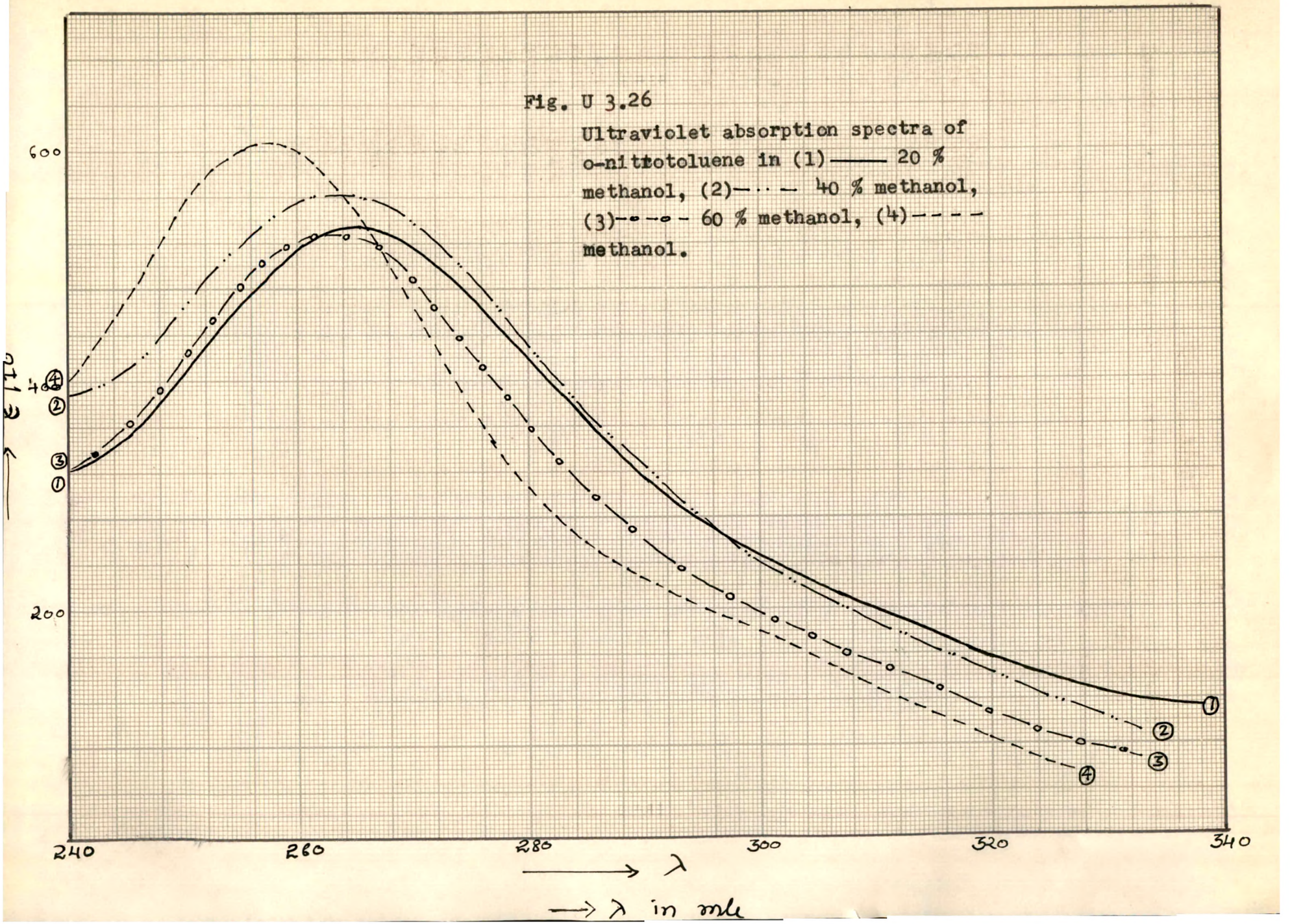


Fig. U 3.26
Ultraviolet absorption spectra of o-nitrotoluene in (1)——— 20 % methanol, (2)—··— 40 % methanol, (3)-•-•- 60 % methanol, (4)- - - - methanol.

Table U 3.26

Ultraviolet absorption spectra of o-nitro toluene in methanol and aqueous methanols.

% methanol :	0	10	20	40	60	80	100
λ (mμ)			ϵ				
240	2541	2740	3255	3911	3228	3120	4036
46	3131	3317	3651	4207	3758	3848	4937
50	3636	3848	4083	4684	4271	4396	5584
52	3892	4145	4315	4891	4504	4667	5826
54	4130	4396	4567	5106	4756	4855	5978
56	4396	4638	4810	5334	4990	5053	6024
58	4586	4909	4990	5472	5116	5142	6042
60	4749	4980	5196	5569	5206	5079	5978
62	4844	5079	5295	5610	5232	5174	5808
64	4893	5142	5306	5619	5323	5062	5580
66	4893	5142	5306	5568	5160	4927	5322
68	4816	5072	5250	5493	5035	4684	4990
70	4749	4937	5142	5322	4927	4477	4604
72	4577	4838	4980	5170	4622	4226	4226
74	4435	4630	4810	4980	4340	3948	3920
76	4264	4351	4604	4746	4101	3695	3604
78	4054	4217	4406	4481	3858	3417	3291
80	3845	3974	4190	4271	3614	3164	3048
84	3369	3551	3758	3813	3202	2707	2643
88	2988	3156	3354	3370	2760	2401	2393
92	2645	2787	2985	2993	2445	2167	2176
96	2360	2535	2688	2707	2185	1960	2014
300	2151	2283	2473	2481	1987	1789	1825
04	1951	2059	2282	2167	1840	1610	1628
08	1799	1897	2121	1978	1618	1447	1421
12	1617	1736	1924	1807	1456	1276	1205
16	1437	1592	1762	1618	1268	1097	1007
20	1313	1421	1573	1430	1115	953	845
24	1161	1249	1456	1276	962	800	719
26	1173	1178	1393	1223	872	755	678
330	971	1025	1249	1070	773	656	611

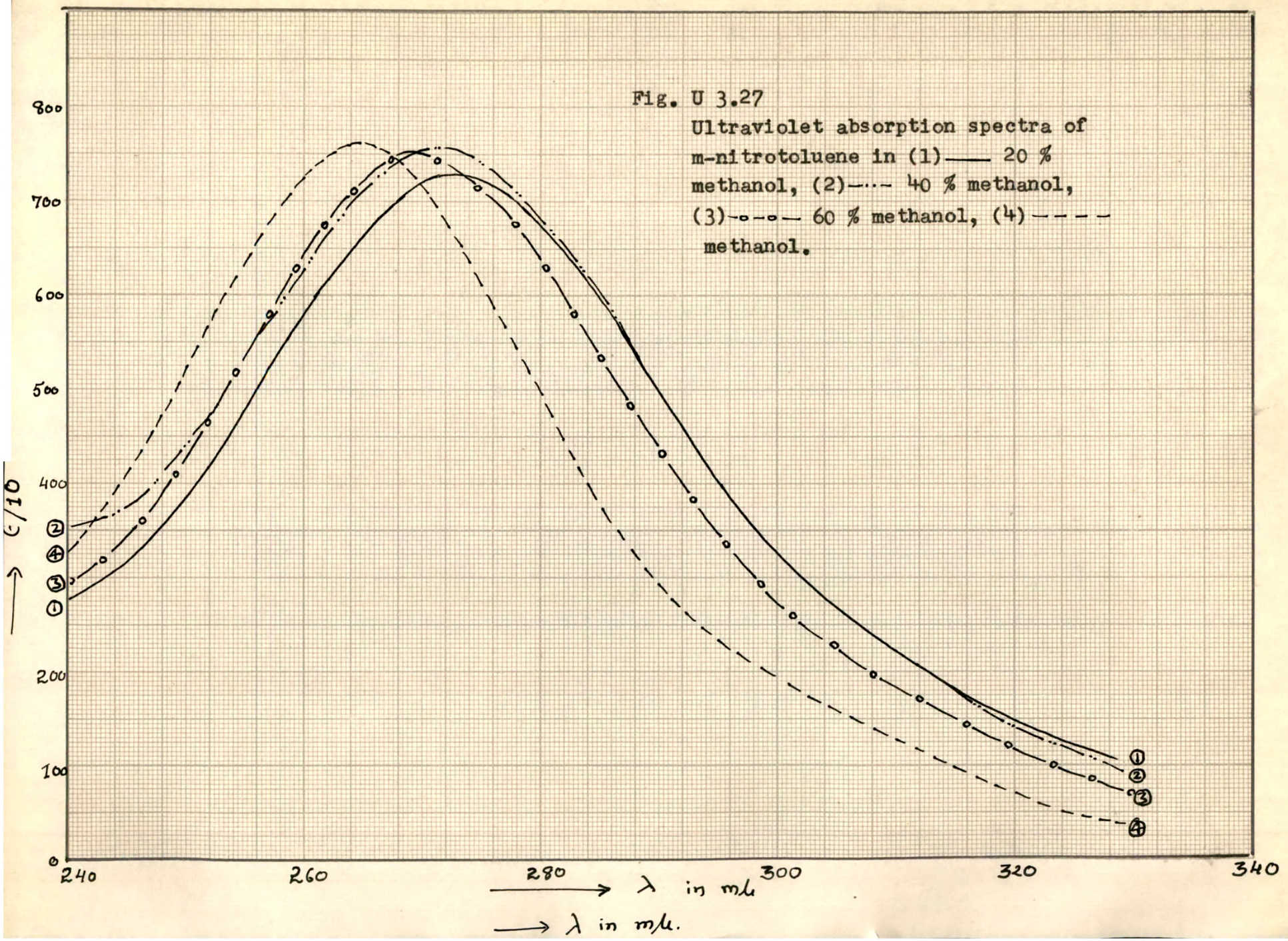


Fig. U 3.27
Ultraviolet absorption spectra of m-nitrotoluene in (1)—— 20 % methanol, (2)—··· 40 % methanol, (3)-o-o— 60 % methanol, (4)– – – – methanol.

Table U 3.27

Ultraviolet absorption spectra of m-nitro toluene in methanol and aqueous methanols.

% methanol :	0	10	20	40	60	80	100
$\lambda(m\mu)$				ϵ			
240	2318	2492	2859	3593	2898	2839	3258
46	2966	3077	3315	3911	3634	3722	4427
52	4014	4150	4269	4786	4784	5023	5846
54	4399	4556	4616	5363	5363	5499	6263
56	4773	4923	5013	5637	5637	5957	6671
58	5184	5380	5470	6006	6075	6343	7047
60	5584	5757	5837	6372	6471	6730	7297
62	5907	6145	6234	6770	6860	7049	7525
64	6181	6442	6542	7037	7108	7256	7525
66	6492	6730	6839	7266	7335	7568	7554
68	6705	6890	7068	7442	7464	7425	7554
70	6879	7068	7246	7525	7464	7345	7166
72	6953	7127	7246	7525	7425	7186	6829
74	6855	7068	7246	7464	7297	6968	6343
76	6754	6949	7157	7350	7037	6612	5916
78	6594	6770	6945	7049	6730	6253	5420
80	6331	6572	6741	6790	6393	5846	4904
84	5626	5957	6105	6277	5569	4906	3951
88	5097	5201	5370	5340	4725	4110	3197
92	4401	4486	4606	4486	3951	3386	2671
96	3701	3812	3872	3881	3275	2819	2214
300	3128	3226	3266	3186	2739	2373	1905
04	2629	2739	2770	2701	2343	2035	1658
08	2256	2323	2342	2333	1995	1757	1400
12	1919	2045	2045	2005	1697	1479	1181
16	1645	1727	1747	1707	1450	1241	953
20	1408	1469	1499	1430	1201	1022	754
24	1296	1261	1280	1231	1002	824	566
28	985	1062	1072	1022	814	675	467
330	910	962	972	943	725	616	427

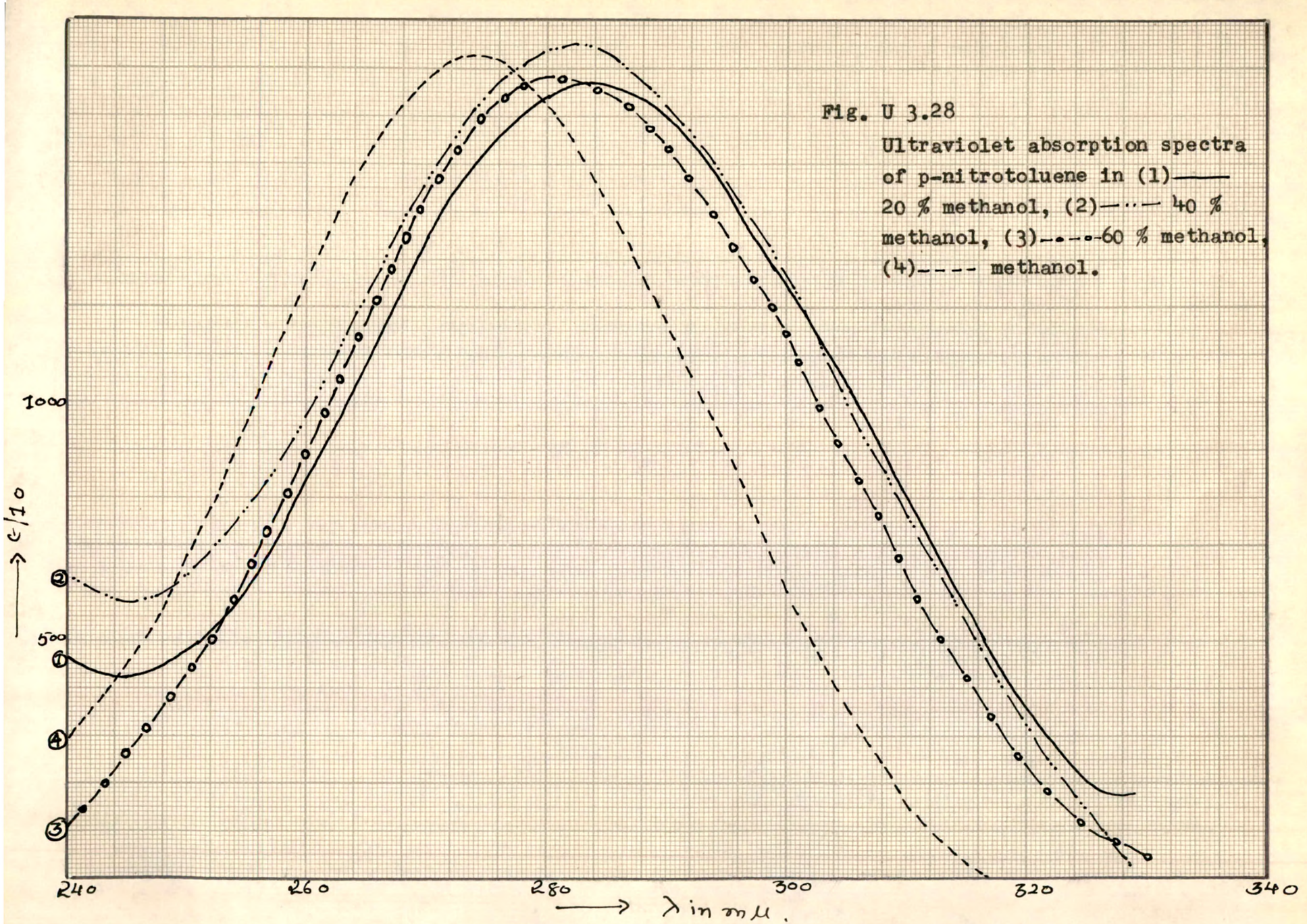


Fig. U 3.28
Ultraviolet absorption spectra of p-nitrotoluene in (1)——— 20 % methanol, (2)—··— 40 % methanol, (3)—•—•—60 % methanol, (4)---- methanol.

Table U 3.28

Ultraviolet absorption spectra of p-nitro toluene in methanol and 10 % aqueous methanols.

% methanol :	0	10	20	40	60	80	100
λ(mμ)			ϵ				
240	1768	1971	3346	4289	1519	2550	2524
46	2178	2348	3161	3982	-	2935	3510
52	3029	3161	3634	4454	-	4126	5008
56	3798	3982	4289	5132	-	5152	6158
60	4666	4906	5193	6034	-	6219	7348
62	5190	5419	5685	6507	6158	6814	7903
64	5632	5891	6138	6937	-	7348	8416
66	6156	6404	6691	7450	7225	7881	8826
68	6680	6916	7246	7881	-	8292	9154
70	7073	7430	7718	8375	8230	8704	9407
72	7674	7841	8149	8704	-	9033	9605
74	7825	8170	8517	9126	8908	9258	9605
76	8153	8478	8867	9361	9196	9340	9561
78	8383	8642	9051	9566	9317	9380	9319
80	8596	8867	9276	9750	9361	9380	9114
82	8678	8991	9340	9750	9361	9237	8786
84	8760	8991	9340	9750	9276	9012	8485
86	8662	8991	9276	9627	9196	8784	7984
88	8547	8908	9154	9426	8950	8395	7496
90	8383	8704	8991	9154	8724	8046	6989
92	8250	8580	8784	8867	-	7595	6384
94	8005	8271	8437	8600	7984	7163	5829
98	7335	7573	7678	7759	7163	6015	4679
302	6646	6794	6916	6753	6179	5091	3604
06	5828	5912	5994	5788	5193	4024	2689
10	4911	5008	5008	4803	4126	3192	1847
14	4012	4126	4105	3880	3346	2299	1314
18	3225	3325	3222	2977	2586	1663	924
22	2505	2627	2565	2276	1991	1212	-
26	1932	1991	1971	1724	1560	942	-
330	1523	-	-	-	-	-	-

3.2

SORPTION EQUILIBRIUM STUDIES

Table E 3.01

Sorption of methyl substituted 7-hydroxycoumarins with sulfonic acid cation exchange resin in H^+ form and in 10 % aqueous methanol as solvent.

Resin =	X4		X8		X12	
Compound	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
7-OHI	1.20	6.0	-	-	-	-
	2.35	12.0	-	-	-	-
	2.75	14.0	-	-	-	-
	4.00	20.0	-	-	-	-
	5.50	28.0	-	-	-	-
7-OH-5-MeI	0.36	3.4	0.36	3.0	0.41	2.6
	0.70	6.4	0.80	6.2	0.84	5.2
	1.06	9.6	1.19	9.2	1.28	7.8
	1.40	12.8	1.56	12.0	1.70	10.6
	1.75	15.8	1.97	15.0	2.10	13.0
7-OH-8-MeI	0.25	2.6	0.26	2.7	0.30	2.0
	0.48	4.9	0.52	5.2	0.59	4.0
	0.71	7.4	0.77	7.6	0.90	6.1
	0.93	9.8	1.02	10.2	1.20	8.1
	1.21	11.7	1.28	12.7	1.46	9.8

Table E 3.02

Sorption of methyl substituted 7-methoxycoumarins with sulfonic acid cation exchange resin in H^+ form in 10 % aqueous methanol as solvent.

Resin	X4		X8		X12	
Compound	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
7-MeOI	0.50	6.0	0.37	3.4	0.40	3.0
	1.20	14.0	0.76	6.9	0.82	6.2
	1.80	22.0	1.17	10.5	1.25	9.5
	2.45	28.0	1.62	14.4	1.70	12.8
	3.00	34.0	1.95	17.6	2.10	15.6
7-MeO-4-MeI	0.26	4.0	0.29	4.4	0.30	3.9
	0.54	8.4	0.58	8.4	0.65	7.8
	0.80	12.2	0.89	12.8	0.96	11.6
	1.08	16.4	1.19	17.2	1.40	17.0
	1.30	19.6	1.56	22.4	1.69	20.2
7-MeO-5-MeI	0.27	4.4	0.28	4.5	0.31	4.1
	0.52	8.6	0.55	8.8	0.63	8.2
	0.77	12.9	0.89	14.2	0.95	12.4
	1.05	17.5	1.12	17.8	1.30	17.0
	1.26	21.0	1.40	22.3	1.56	20.4
7-MeO-8-MeI	0.18	3.6	0.19	3.7	0.21	3.3
	0.33	6.7	0.29	6.0	0.42	6.6
	0.49	9.9	0.61	12.0	0.62	9.8
	0.65	13.3	0.73	14.3	0.82	12.9
	0.79	16.0	0.92	18.0	1.00	15.7

Table E 3.03

Sorption of trisubstituted hydroxycoumarins with resin 50WX4 in H^+ form in aqueous methanols.

% methanol =	10		20		30	
Compound	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
4-Me-5,7-diOHI	0.25	3.6	0.25	2.0	0.25	1.2
	0.50	7.2	0.50	4.0	0.75	3.4
	0.75	10.6	0.75	6.0	1.25	6.0
	1.00	14.2	1.06	8.0	1.75	8.4
	1.25	17.8	1.25	10.0	2.25	10.6
4-Me-7,8-diOHI	1.00	5.0	0.75	2.0	1.00	1.0
	2.00	9.8	1.50	4.0	2.00	2.0
	3.00	14.6	2.00	5.4	3.00	2.8
	4.00	19.4	3.00	8.1	4.00	3.8
	5.00	24.2	4.00	10.8	5.00	4.8
4,5-diMe-7-OHI	0.20	9.0	0.20	5.5	0.40	5.0
	0.40	17.5	0.40	11.5	0.60	8.0
	0.60	25.5	0.70	20.0	0.80	10.5
	0.80	34.0	0.90	25.0	1.00	13.0
	0.94	40.0	1.20	33.0	1.40	18.0
4,8-diMe-7-OHI	0.25	4.5	0.50	5.0	0.50	2.7
	0.50	9.5	1.00	9.5	0.90	5.0
	1.00	19.5	1.50	14.5	1.80	10.0
	1.50	29.0	2.00	19.0	2.70	15.0
	1.80	35.0	2.50	24.0	3.65	20.0

Table E 3.03 (contd.)

4,7-diMe-5-OHI	-	-	0.14	0.8	0.40	1.8
	-	-	0.28	1.6	0.80	3.6
	-	-	0.42	2.4	1.10	5.0
	-	-	0.52	3.0	1.60	7.2
	-	-	0.80	4.6	1.96	8.8
4,7-diMe-5-MeOI	-	-	0.18	1.4	0.50	2.6
	-	-	0.28	2.2	0.90	4.8
	-	-	0.46	3.6	1.20	6.4
	-	-	0.56	4.4	1.50	8.0
	-	-	0.74	5.8	1.80	9.6

Table E 3.04

Sorption of trisubstituted methoxycoumarins with sulfonic acid cation exchange resin in H^+ form in 10 % aqueous methanol as solvent.

Resin =	X4		X8		X12	
Compound	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
7-MeO-4,8-diMeI	0.15	5.0	0.25	8.5	0.15	3.5
	0.25	8.5	0.35	12.0	0.25	6.0
	0.40	14.0	0.45	15.5	0.40	9.5
	0.55	19.5	0.55	19.0	0.50	12.0
	0.65	23.0	0.65	22.5	0.75	18.0
7,8-diMeO-4-MeI	0.40	4.5	0.10	1.0	0.40	3.0
	0.60	6.7	0.50	4.7	0.75	5.5
	0.80	9.0	0.95	9.0	1.25	9.0
	1.00	11.2	1.30	12.3	1.60	11.5
	1.25	14.0	1.70	16.0	1.80	13.0
5,7-diMeO-4-MeI	0.14	5.0	0.09	3.5	0.10	3.0
	0.22	8.0	0.16	6.0	0.18	5.5
	0.30	11.0	0.24	9.0	0.23	7.0
	0.37	13.5	0.32	12.0	0.31	9.5
	0.41	15.0	0.41	15.4	0.33	11.0

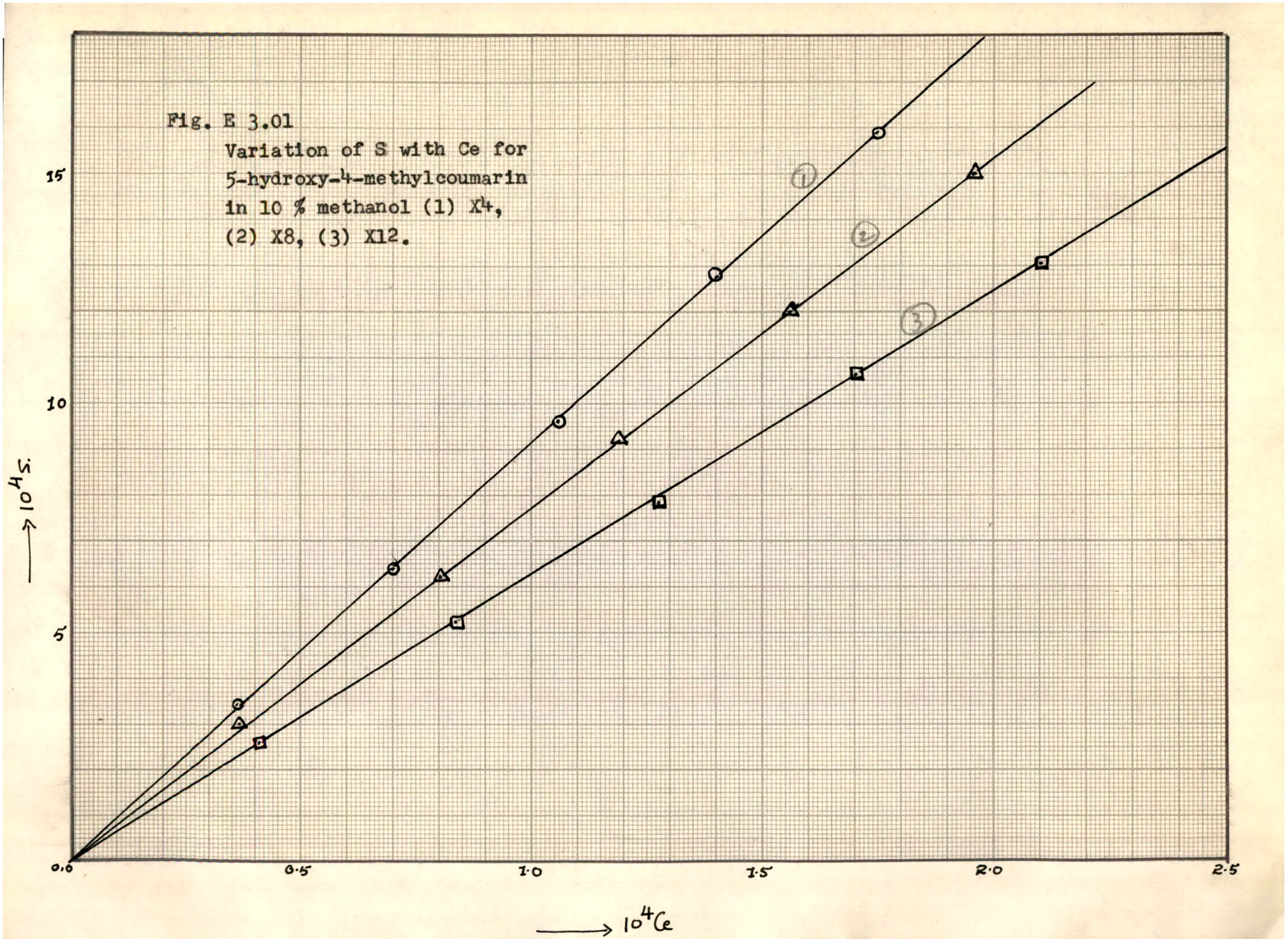


Fig. E 3.01
Variation of S with Ce for 5-hydroxy-4-methylcoumarin in 10 % methanol (1) X4, (2) X8, (3) X12.

Table E 3.05

Sorption of 4-methylcoumarins with sulfonic acid cation exchange resin in H^+ form in 10 % aqueous methanol as solvent

Resin	X4		X8		X12		X16	
Compound	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
4-MeI	0.20	1.8	-	-	-	-	-	-
	0.60	5.6	-	-	-	-	-	-
	1.00	9.0	-	-	-	-	-	-
	1.40	13.0	-	-	-	-	-	-
	1.80	16.6	-	-	-	-	-	-
4-Me-5-OHI	0.30	4.0	0.45	3.0	0.48	2.4	0.94	4.4
	0.60	8.0	0.90	5.8	1.00	5.2	1.60	7.8
	0.90	12.0	1.40	9.2	1.70	9.0	2.40	11.8
	1.20	16.0	1.80	12.0	2.10	11.0	3.00	15.0
	1.60	21.0	2.40	16.0	2.40	12.6	3.60	18.0
4-Me-6-OHI	1.00	7.0	0.52	2.4	0.60	2.0	-	-
	1.95	14.0	1.00	4.8	1.30	4.4	-	-
	2.50	18.0	1.90	9.0	2.00	7.0	-	-
	3.50	25.0	2.60	12.0	2.80	9.8	-	-
	4.00	29.0	3.40	16.0	3.40	12.0	-	-
4-Me-7-OHI	0.72	6.0	0.40	2.2	0.50	2.0	0.70	2.0
	0.90	10.0	0.80	4.4	1.00	4.0	1.20	3.4
	1.42	16.0	1.20	6.8	1.50	6.0	1.70	5.0
	1.80	20.0	1.60	9.0	2.00	8.0	2.40	7.0
	2.10	23.0	2.00	11.4	2.50	10.0	3.10	9.0

Table E 3.05 (contd.)

4-Me-6-MeOI	0.50	6.0	0.32	3.2	0.36	2.7	0.36	2.4
	1.00	12.0	0.70	7.0	0.75	5.8	0.74	4.8
	1.85	22.0	1.00	9.8	1.10	7.8	1.10	7.2
	2.75	32.0	1.35	13.3	1.45	10.5	1.40	9.2
	3.70	44.0	1.60	15.8	1.82	13.0	1.80	11.6
4-Me-7-MeOI	0.26	4.0	0.29	4.3	0.32	3.9	-	-
	0.52	8.0	0.58	8.4	0.65	7.8	-	-
	0.81	12.2	0.89	12.8	0.96	11.8	-	-
	1.08	16.3	1.19	17.2	1.40	17.0	-	-
	1.30	19.6	1.60	23.0	2.00	24.0	-	-
4,6-diMeI	0.10	1.8	0.34	4.3	0.40	3.6	0.38	3.2
	0.40	7.0	0.69	8.2	0.78	7.2	0.77	6.3
	0.60	10.6	1.06	12.6	1.18	11.0	1.16	9.6
	0.90	16.0	1.44	16.6	1.59	14.7	1.58	12.9
	1.20	21.0	1.80	21.0	2.00	18.4	1.99	16.0
4,7-diMeI	0.20	4.0	0.30	4.7	0.35	4.0	0.40	3.6
	0.40	8.0	0.60	9.0	0.72	7.9	0.86	8.0
	0.70	14.0	0.93	13.8	1.08	11.9	1.30	12.2
	0.90	18.0	1.23	18.5	1.43	16.0	1.70	16.0
	1.10	22.0	1.52	22.9	1.78	19.5	2.20	20.8

Table E 3.06

Sorption of monohydroxy-4-methylcoumarins in 10 % aqueous methanol on resin 50WX4 with different organic counter ions.

Compound	5-OH-4-MeI		6-OH-4-MeI		7-OH-4-MeI	
Counter ion	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
Anilinium	0.50	9.0	0.46	3.6	0.30	4.8
	0.80	12.0	0.90	6.8	0.80	13.0
	1.20	21.0	1.30	10.0	1.10	18.0
	1.50	26.0	1.80	13.8	1.60	26.0
	1.90	33.0	2.40	18.4	2.10	34.0
Methylanilinium	0.40	3.0	0.60	7.6	0.60	8.0
	0.80	11.8	1.00	13.0	0.90	12.0
	1.20	18.0	1.50	19.6	1.40	18.6
	1.60	24.0	2.00	26.0	1.80	24.0
	2.00	29.8	2.30	30.0	2.40	32.0
Dimethyl-anilinium	0.40	9.0	0.50	5.4	0.20	3.0
	0.70	15.8	1.10	12.0	0.50	8.0
	1.00	22.6	1.80	20.0	1.00	16.0
	1.20	27.2	2.30	25.6	1.50	24.0
	1.50	34.0	2.70	30.0	2.00	32.0
Ethylanilinium	0.40	8.4	0.50	6.4	0.60	10.0
	0.70	12.8	1.00	13.0	0.90	15.0
	1.00	21.2	1.30	17.0	1.30	22.0
	1.30	27.4	1.90	25.0	1.60	27.0
	1.60	34.0	2.20	29.0	2.00	33.8

Table E 3.06 (contd.)

Diethylammonium	0.24	4.8	0.40	4.0	0.50	6.0
	0.50	9.4	1.00	10.4	1.00	11.8
	0.78	14.4	1.60	16.6	1.50	18.0
	1.03	19.4	2.20	23.0	2.00	24.0
	1.38	26.0	2.60	27.0	2.40	29.0
Triethylammonium	0.30	4.0	0.40	3.6	0.40	4.0
	0.50	7.0	0.80	7.2	0.80	8.0
	0.80	11.0	1.20	10.6	1.20	12.0
	1.10	15.0	1.60	14.4	1.60	16.2
	1.40	19.0	2.00	18.0	2.00	20.2

Table E 3.07

Sorption of coumarin carboxylic acids with sulfonic acid cation exchange resin in H^+ form.

Compound	Resin = Solvent	X4 10^4Ce	X4 10^4S	X8 10^4Ce	X8 10^4S	X12 10^4Ce	X12 10^4S	X16 10^4Ce	X16 10^4S
7-OH-4-MeI-6-COOH	N/100 HCl	0.14	1.0	0.12	0.8	0.08	0.4	0.10	0.60
		0.20	1.4	0.24	1.6	0.20	1.0	0.24	1.4
		0.34	2.4	0.36	2.4	0.32	1.6	0.34	2.0
		0.48	3.4	0.45	3.0	0.48	2.4	0.48	2.8
		0.62	4.4	0.64	4.2	0.65	3.2	0.68	4.0
7-OH-4-MeI-8-COOH	"	0.16	0.8	0.10	0.4	0.07	0.2	0.08	0.2
		0.24	1.2	0.26	1.0	0.20	0.6	0.24	0.6
		0.36	1.8	0.44	1.6	0.34	1.0	0.40	1.0
		0.48	2.4	0.60	2.2	0.54	1.6	0.56	1.4
		0.72	3.6	0.76	2.8	0.68	2.0	0.74	1.8
7-OH-4-MeI-6-COOH	N/10 HCl	0.12	1.0	0.08	0.8	0.10	0.8	0.10	0.6
		0.24	2.0	0.20	1.9	0.20	1.6	0.20	1.2
		0.36	3.0	0.33	3.2	0.32	2.6	0.30	1.8
		0.48	4.0	0.44	4.3	0.44	3.6	0.40	2.4
		0.58	4.8	0.53	5.2	0.56	4.6	0.54	3.2
7-OH-4-MeI-8-COOH	"	0.08	0.6	0.12	0.6	0.10	0.4	0.12	0.4
		0.24	1.8	0.30	1.6	0.20	0.8	0.25	0.8
		0.40	3.0	0.44	2.4	0.40	1.6	0.38	1.2
		0.48	3.6	0.60	3.2	0.60	2.4	0.64	2.0
		0.64	4.8	0.82	4.4	0.74	3.0	0.80	2.5

Table E 3.08

Sorption of methoxycoumarins with sulfonic acid cation exchange resin in H^+ form in 10 % aqueous methanol as solvent

Resin =	X4		X8		X12	
Compound	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
4-MeOI	0.40	4.4	-	-	-	-
	1.00	11.0	-	-	-	-
	1.40	15.2	-	-	-	-
	1.80	19.8	-	-	-	-
	2.00	22.0	-	-	-	-
4,5-diMeOI	0.30	3.5	0.40	4.3	0.40	3.5
	0.55	6.5	0.65	7.0	0.75	6.5
	0.85	10.0	0.90	9.7	1.10	9.5
	1.10	13.0	1.15	12.3	1.40	12.0
	1.40	16.5	1.40	16.0	1.70	14.5
4,6-diMeOI	0.30	4.8	0.20	3.8	0.30	4.5
	0.50	8.0	0.40	7.5	0.50	6.5
	0.65	10.4	0.60	11.2	0.65	10.0
	0.85	13.5	0.75	14.0	0.85	13.0
	1.00	16.0	0.90	16.7	1.05	16.0
4,7-diMeOI	0.20	4.0	-	-	-	-
	0.40	8.0	-	-	-	-
	0.70	14.0	-	-	-	-
	0.90	18.0	-	-	-	-
	1.10	22.0	-	-	-	-

Table E 3.09

Sorption of 4-hydroxycoumarins with sulfonic acid cation exchange resin in H^+ form.

Compound	Resin Solvent	X4		X8		X12		X16	
		10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
4-OH-3-MeI	10 % MeOH	1.00	8.8	0.53	3.3	0.60	3.0	0.60	3.2
		1.50	13.0	1.00	6.2	1.15	5.7	1.10	5.6
		2.00	17.6	1.60	9.9	1.73	8.4	1.64	8.5
		2.50	22.0	2.10	13.0	2.30	11.0	2.30	11.8
		3.00	26.2	2.60	16.2	2.80	13.4	2.70	14.2
4-OH-6-MeI	"	0.50	6.0	0.41	3.2	0.48	3.5	0.50	2.4
		0.80	9.6	0.89	8.4	0.90	6.5	1.00	5.0
		1.00	12.0	1.40	13.0	1.47	10.6	1.36	6.8
		1.20	14.4	1.78	16.6	2.00	14.3	1.82	9.0
		1.50	18.0	2.26	21.0	2.50	17.8	2.30	11.6
4-OH-3-MeI	10 % MeOH in N/100 HCl	0.50	4.4	0.56	3.5	0.64	3.0	0.63	2.5
		1.00	8.8	1.17	6.8	1.20	6.0	1.31	4.4
		1.50	13.2	1.80	10.2	1.90	8.6	1.92	7.0
		2.00	17.8	2.30	13.4	2.50	11.6	2.59	9.4
		2.50	22.2	2.96	16.8	3.16	14.5	3.20	11.6

Table E 3.09 (contd.)

4-OH-6-MeI	10 % MeOH in N/100 HCl	0.50	3.6	0.50	4.7	0.56	4.4	0.60	4.0
		1.00	7.2	1.00	9.4	1.10	8.5	1.18	7.8
		1.50	11.0	1.52	14.0	1.65	12.7	1.68	11.2
		2.00	15.0	2.00	18.6	2.20	17.0	2.40	16.0
		2.50	18.6	2.60	24.0	2.80	21.4	3.00	20.0
4-OH-3-MeI	10 % MeOH in N/10 HCl	0.60	3.4	0.85	4.4	0.60	3.9	0.58	3.2
		1.00	9.2	1.00	8.0	1.16	7.7	1.16	6.7
		1.53	13.8	1.60	12.6	1.74	11.6	1.80	10.2
		1.95	18.0	2.18	17.3	2.36	14.9	2.40	13.6
		2.40	22.4	2.80	22.0	2.94	18.9	2.93	16.6
4-OH-6-MeI	"	0.40	6.0	0.43	5.1	0.49	4.4	0.54	3.0
		0.74	10.8	0.86	10.5	1.00	9.0	1.10	6.2
		1.10	16.0	1.33	15.4	1.49	13.3	1.66	9.3
		1.50	21.4	1.80	21.0	2.00	18.0	2.30	13.0
		1.80	26.0	2.30	27.0	2.60	21.4	3.00	17.0

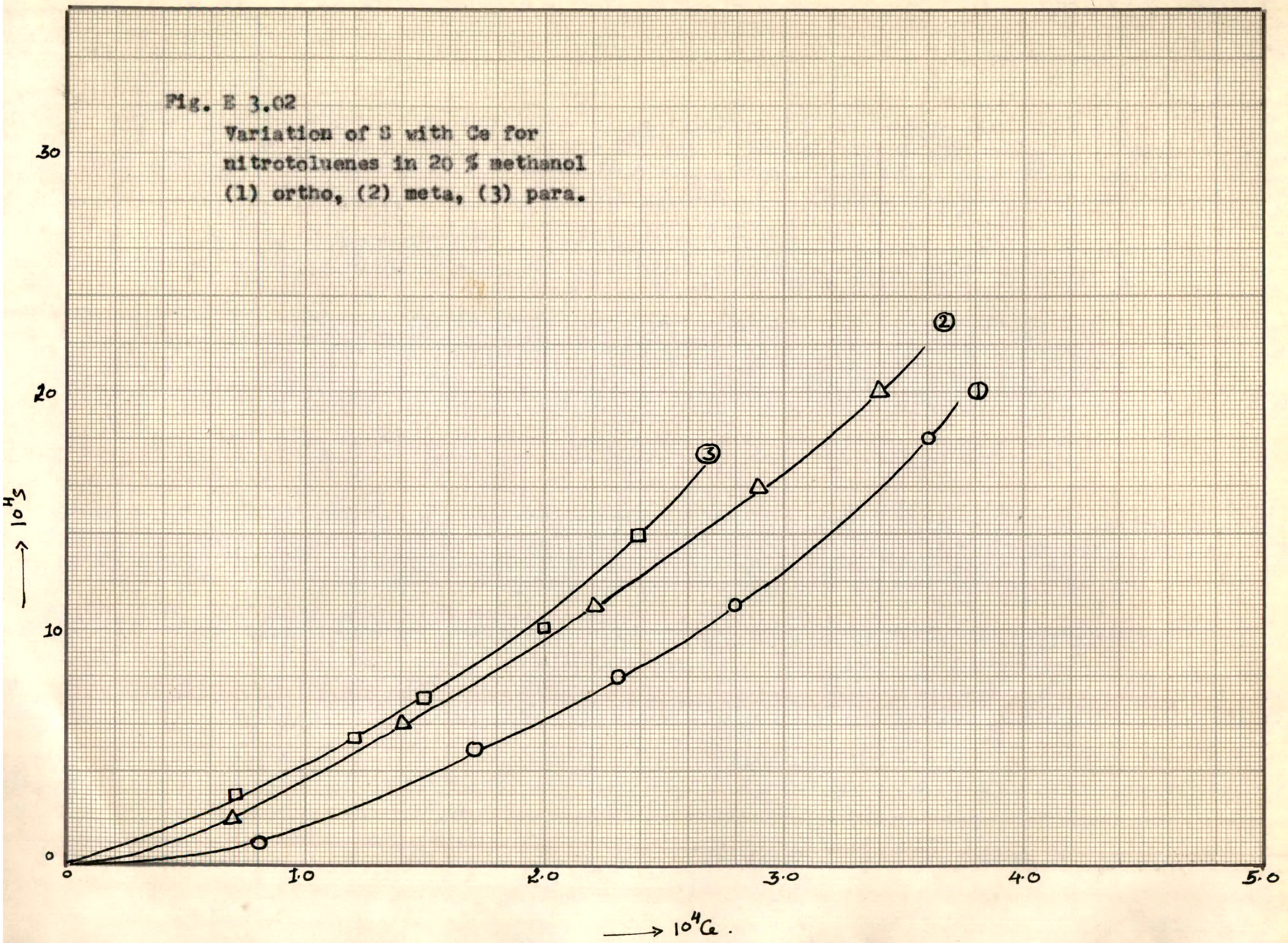


Fig. E 3.02
Variation of S with Ce for
nitrotoluenes in 20 % methanol
(1) ortho, (2) meta, (3) para.

Table E 3.10

Sorption of o-, m-, and p-nitro toluene with sulfonic acid cation exchange resin 50WX4 in H^+ form, using 10 % aqueous ter. butanol and 20 % aqueous methanol as solvent.

Compound :	o-nitro		m-nitro		p-nitro	
Solvent	10^4Ce	10^4S	10^4Ce	10^4S	10^4Ce	10^4S
10 % aq. ter. butanol	0.60	5.0	0.60	6.0	0.40	3.6
	1.20	10.0	1.40	14.0	1.00	8.6
	1.70	14.0	2.10	21.0	1.60	14.0
	2.40	20.0	2.80	28.0	2.30	20.0
	3.00	25.0	3.40	34.0	3.00	26.0
20 % aq. methanol	0.80	1.0	0.70	2.0	0.70	3.0
	1.70	5.0	1.40	6.0	1.20	5.4
	2.30	8.0	2.20	11.0	1.50	7.0
	2.80	11.0	2.90	16.0	2.00	10.0
	3.60	18.0	3.40	22.0	2.40	14.0

3.3

COLUMN STUDIES

Table R 3.01

Column elution of substituted 7-hydroxycoumarins on column A with 10 % aqueous methanol as solvent and eluant.

Compound	7-OH-4-MeI	7-OH-5-MeI	7-OH-8-MeI
10^2W =	4.39	6.02	1.74
Sample No.		10^2Ws =	
v.v.	-	-	-
1-13	-	-	-
14	0.10	-	-
15	0.36	-	-
16	0.90	-	0.01
17	1.40	0.07	0.05
18	0.90	0.34	0.13
19	0.50	0.97	0.26
20	0.22	1.39	0.37
21	0.09	1.43	0.38
22	0.02	0.99	0.29
23	-	0.51	0.16
24	-	0.22	0.07
25	-	0.08	0.02
26	-	0.02	-
27	-	-	-

Table R 3.02

Column elution of substituted 7-hydroxy-4-methylcoumarins on column A with 10 % aqueous methanol as solvent and eluqnt.

Compound	7,8-diOH-4-MeI	5,7-diOH-4-MeI	7-OH-4,8-diMeI
10^2W =	2.76	3.71	4.34
Sample No.		10^2Ws =	
v.v.	-	-	-
1-7	-	-	-
8	0.09	-	-
9	0.20	-	-
10	1.35	-	-
11	0.80	-	-
12	0.22	-	-
13	0.10	-	-
14-20	-	-	-
21	-	0.05	-
22	-	0.14	-
23	-	0.22	-
24	-	0.32	0.02
25	-	0.40	0.06
26	-	0.41	0.14
27	-	0.42	0.28
28	-	0.40	0.37
29	-	0.36	0.45
30	-	0.30	0.54
31	-	0.24	0.55
32	-	0.18	0.46
33	-	0.12	0.40
34	-	0.10	0.30
35	-	0.05	0.25
36	-	-	0.20
37	-	-	0.12
38	-	-	0.10
39	-	-	0.06
40	-	-	0.04
41	-	-	-

Table R 3.03

Column elution of 7-methoxycoumarins on column A with 10 % aqueous methanol as solvent and eluant.

Compound	7-MeO-4-MeI	7-MeO-5-MeI	7-MeO-8-MeI
10^2W =	3.3	2.05	1.95
Sample No.		10^2Ws =	
v.v.	-	-	-
1-27	-	-	-
28	0.02	-	-
29	0.04	-	-
30	0.09	-	-
31	0.16	-	-
32	0.25	0.02	-
33	0.34	0.05	-
34	0.42	0.08	-
35	0.45	0.12	0.02
36	0.42	0.17	0.03
37	0.36	0.23	0.05
38	0.28	0.27	0.08
39	0.19	0.28	0.12
40	0.12	0.26	0.16
41	0.09	0.21	0.21
42	0.04	0.15	0.24
43	0.03	0.10	0.24
44	0.01	0.06	0.24
45	-	0.03	0.21
46	-	0.02	0.16
47	-	-	0.11
48	-	-	0.08
49	-	-	0.05
50	-	-	0.03
51	-	-	0.02
52	-	-	-

Table R 3.04

Column elution of substituted 7-methoxy-4-methylcoumarins on column A with 10 % aqueous methanol as solvent and eluant.

Compound	7,8-diMeO-4-MeI	5,7-diMeO-4-MeI	7-MeO-4,8-diMeI
10^2W =	3.23	1.93	2.24
Sample No.		10^2Ws =	
v.v.	-	-	-
1-17	-	-	-
18	0.02	-	-
19	0.03	-	-
20	0.05	-	-
21	0.14	-	-
22	0.28	-	-
23	0.45	-	-
24	0.58	-	-
25	0.58	-	-
26	0.46	-	-
27	0.31	-	-
28	0.18	-	-
29	0.09	-	-
30	0.04	-	-
31	0.02	-	-
32-52	-	-	-
53	-	-	0.02
54	-	-	0.03
55	-	-	0.05
56	-	-	0.08
57	-	-	0.11
58	-	-	0.14
59	-	-	0.16
60	-	-	0.17
61	-	-	0.18
62	-	-	0.18
63	-	-	0.18
64	-	-	0.16

Table R 3.04 (contd.)

65	-	-	0.14
66	-	-	0.13
67	-	-	0.10
68	-	0.02	0.08
69	-	0.03	0.07
70	-	0.03	0.06
71	-	0.04	0.04
72	-	0.06	0.03
73	-	0.07	0.02
74	-	0.08	0.01
75	-	0.09	0.01
76	-	0.10	-
77	-	0.11	-
78	-	0.11	-
79	-	0.12	-
80	-	0.11	-
81	-	0.10	-
82	-	0.10	-
83	-	0.10	-
84	-	0.09	-
85	-	0.08	-
86	-	0.08	-
87	-	0.07	-
88	-	0.06	-
89	-	0.06	-
90	-	0.05	-
91	-	0.04	-
92	-	0.04	-
93	-	0.03	-
94	-	0.02	-
95	-	0.02	-
96	-	0.01	-
97	-	0.01	-
98	-	-	-

Table R 3.05

Column elution of substituted dimethylcoumarins on column A with 20 % aqueous methanol as solvent and eluant.

Compound :	7-OH-4,5-diMeI	5-OH-4,7-diMeI	5-MeO-4,7-diMeI
10^2W =	1.82	0.82	1.02
Sample No.		10^2Ws =	
v.v.	-	-	-
1-23	-	-	-
24	-	0.02	-
25	-	0.05	-
26	-	0.08	-
27	-	0.10	-
28	-	0.12	-
29	-	0.13	-
30	-	0.11	-
31	-	0.09	-
32	-	0.06	-
33	-	0.04	-
34	-	0.02	-
35-36	-	-	-
37	-	-	0.02
38	-	-	0.04
39	-	-	0.06
40	-	-	0.09
41	-	-	0.11
42	-	-	0.13
43	-	-	0.13
44	-	-	0.12
45	0.01	-	0.10
46	0.03	-	0.08
47	0.05	-	0.06
48	0.08	-	0.04
49	0.12	-	0.03
50	0.15	-	0.01
51	0.18	-	-
52	0.19	-	-
53	0.20	-	-
54	0.19	-	-
55	0.17	-	-
56	0.14	-	-
57	0.10	-	-
58	0.07	-	-
59	0.04	-	-
60	0.02	-	-
61	0.01	-	-
62	-	-	-

Table R 3.06

Column elution of substituted dimethylcoumarins on column A with 30 % aqueous methanol as solvent and eluant.

Compound :	7-OH-4,5-diMeI	5-OH-4,7-diMeI	5-MeO-4,7-diMeI
10^2W =	2.66	1.27	1.54
Sample No.		10^2Ws =	
v.v.	-	-	-
1-10	-	-	-
11	-	0.02	-
12	-	0.05	-
13	-	0.18	-
14	-	0.32	-
15	-	0.34	0.03
16	-	0.23	0.04
17	-	0.10	0.05
18	-	0.03	0.07
19	-	-	0.13
20	-	-	0.21
21	-	-	0.27
22	0.02	-	0.27
23	0.08	-	0.22
24	0.17	-	0.14
25	0.32	-	0.08
26	0.46	-	0.03
27	0.51	-	-
28	0.45	-	-
29	0.32	-	-
30	0.19	-	-
31	0.09	-	-
32	0.04	-	-
33	0.01	-	-
34	-	-	-

Table R 3.07

Column elution of 5-methoxy-4,7-dimethylcoumarin on column A with 40 % aqueous methanol as solvent and eluant.

10^2W =	1.72
Sample No.	10^2Ws =
v.v.	-
1-6	-
7	0.05
8	0.17
9	0.41
10	0.49
11	0.22
12	0.38 ? 0.08 ?
13	-

Table R 3.08

Column elution of some substituted coumarins on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	6-OH-4-MeI	4,6-diMeI	4,6-diMeOI	4,5-diMeOI
10^2W =	10.19	5.63	3.96	2.90
Sample No.		10^2Ws =		
v.v.	-	-	-	-
1-10	-	-	-	-
11	0.20	-	-	-
12	0.70	-	-	-
13	2.06	-	-	-
14	3.15	-	-	-
15	2.54	-	-	-
16	1.08	-	-	-
17	0.35	-	-	-
18	0.11	-	-	-
19	-	-	-	-
20	-	-	-	0.02
21	-	0.05	-	0.03
22	-	0.05	-	0.04
23	-	0.11	-	0.06
24	-	0.26	-	0.10
25	-	0.48	-	0.18
26	-	0.70	-	0.26
27	-	0.90	-	0.33
28	-	0.95	-	0.38
29	-	0.72	-	0.38
30	-	0.52	-	0.34
31	-	0.36	0.02	0.27
32	-	0.22	0.02	0.20
33	-	0.12	0.03	0.13
34	-	0.12	0.05	0.08
35	-	0.07	0.08	0.05
36	-	-	0.13	0.03
37	-	-	0.19	0.02

Table R 3.08 (contd.)

38	-	-	0.25	-
39	-	-	0.31	-
40	-	-	0.36	-
41	-	-	0.38	-
42	-	-	0.39	-
43	-	-	0.36	-
44	-	-	0.32	-
45	-	-	0.28	-
46	-	-	0.22	-
47	-	-	0.18	-
48	-	-	0.13	-
49	-	-	0.10	-
50	-	-	0.07	-
51	-	-	0.05	-
52	-	-	0.03	-
53	-	-	0.01	-
54	-	-	-	-

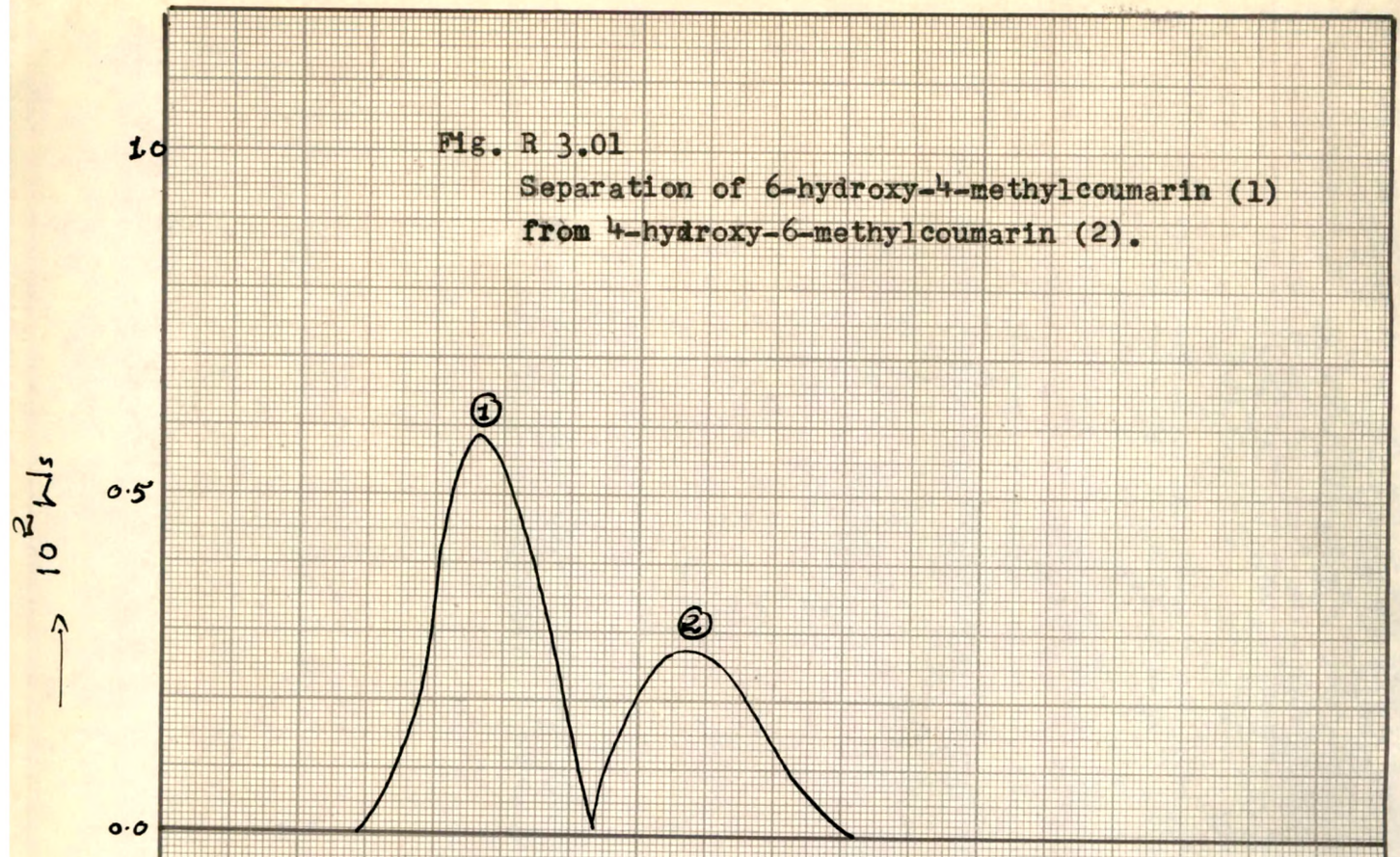


Fig. R 3.01
Separation of 6-hydroxy-4-methylcoumarin (1) from 4-hydroxy-6-methylcoumarin (2).

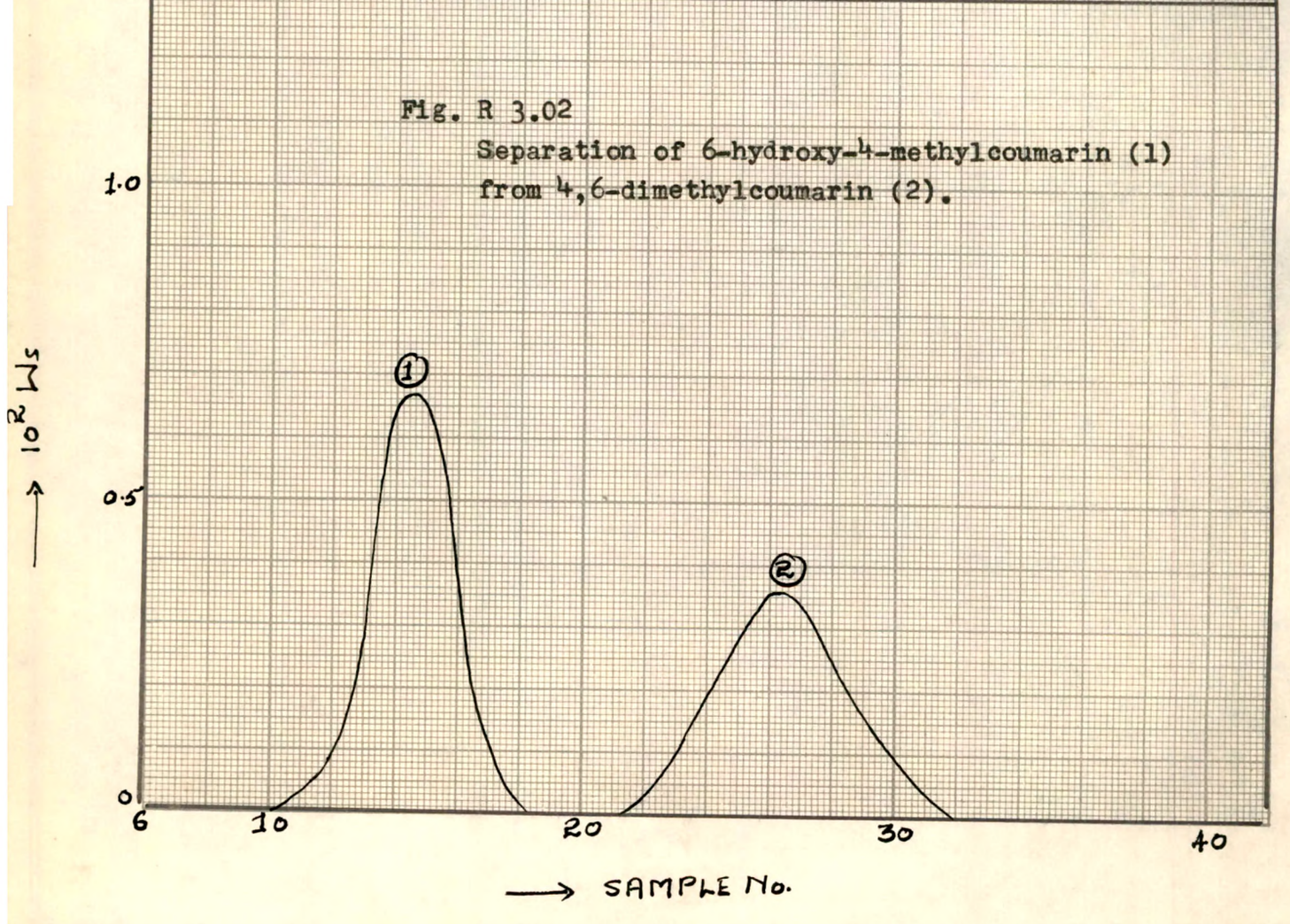


Fig. R 3.02
Separation of 6-hydroxy-4-methylcoumarin (1) from 4,6-dimethylcoumarin (2).

Table R 3.09

Separation of 6-hydroxy-4-methylcoumarin from 4-hydroxy-6-methylcoumarin and 4,6-dimethylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	6-OH-4-MeI + 4-OH-6-MeI		6-OH-4-MeI + 4,6-diMeI	
10^2W =	2.04	1.37	2.07	1.77
Sample No.	10^2Ws =		10^2Ws =	
v.v.	-	-	-	-
1-11	-	-	-	-
12	0.01	-	0.06	-
13	0.12	-	0.31	-
14	0.35	-	0.64	-
15	0.58	-	0.62	-
16	0.51	-	0.33	-
17	0.30	-	0.10	-
18	0.17	-	0.01	-
19	-	0.17	-	-
20	-	0.22	-	-
21	-	0.27	-	-
22	-	0.27	-	0.03
23	-	0.22	-	0.09
24	-	0.13	-	0.16
25	-	0.07	-	0.28
26	-	0.02	-	0.35
27	-	-	-	0.33
28	-	-	-	0.25
29	-	-	-	0.16
30	-	-	-	0.08
31	-	-	-	0.04
32	-	-	-	-

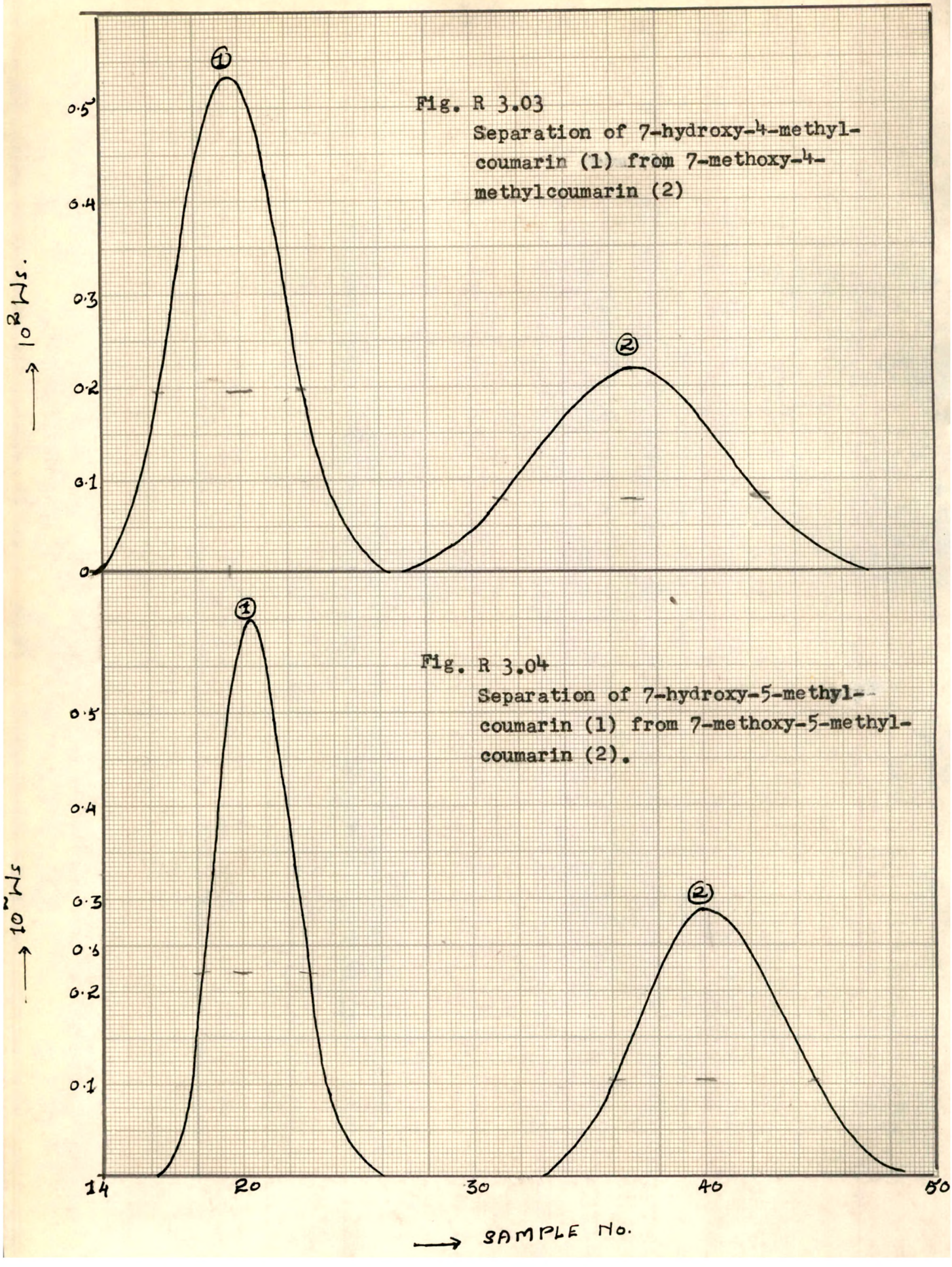


Fig. R 3.03
Separation of 7-hydroxy-4-methyl-coumarin (1) from 7-methoxy-4-methylcoumarin (2)

Fig. R 3.04
Separation of 7-hydroxy-5-methyl-coumarin (1) from 7-methoxy-5-methyl-coumarin (2).

Table R 3.10

Separation of 7-hydroxy-4-methylcoumarin from 7-methoxy-4-methylcoumarin and 7-hydroxy-5-methylcoumarin from 7-methoxy-5-methylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	7-OH-4-MeI +	7-MeO-4-MeI	7-OH-5-MeI +	7-MeO-5-MeI
10^2W =	3.00	2.18	2.39	2.22
Sample No.	10^2Ws =		10^2Ws =	
v.v.	-	-	-	-
1-13	-	-	-	-
14	0.01	-	-	-
15	0.05	-	-	-
16	0.14	-	-	-
17	0.29	-	0.02	-
18	0.43	-	0.17	-
19	0.52	-	0.41	-
20	0.53	-	0.58	-
21	0.45	-	0.56	-
22	0.30	-	0.38	-
23	0.16	-	0.19	-
24	0.08	-	0.06	-
25	0.03	-	0.02	-
26	0.01	-	-	-
27	-	-	-	-
28	-	0.02	-	-
29	-	0.03	-	-
30	-	0.05	-	-
31	-	0.07	-	-
32	-	0.10	-	-
33	-	0.14	-	-
34	-	0.17	-	0.02
35	-	0.19	-	0.05
36	-	0.21	-	0.10
37	-	0.22	-	0.16
38	-	0.21	-	0.22
39	-	0.19	-	0.27
40	-	0.17	-	0.29
41	-	0.14	-	0.28
42	-	0.10	-	0.25
43	-	0.07	-	0.19
44	-	0.05	-	0.15
45	-	0.03	-	0.10
46	-	0.02	-	0.07
47	-	-	-	0.04
48	-	-	-	0.03
49	-	-	-	-

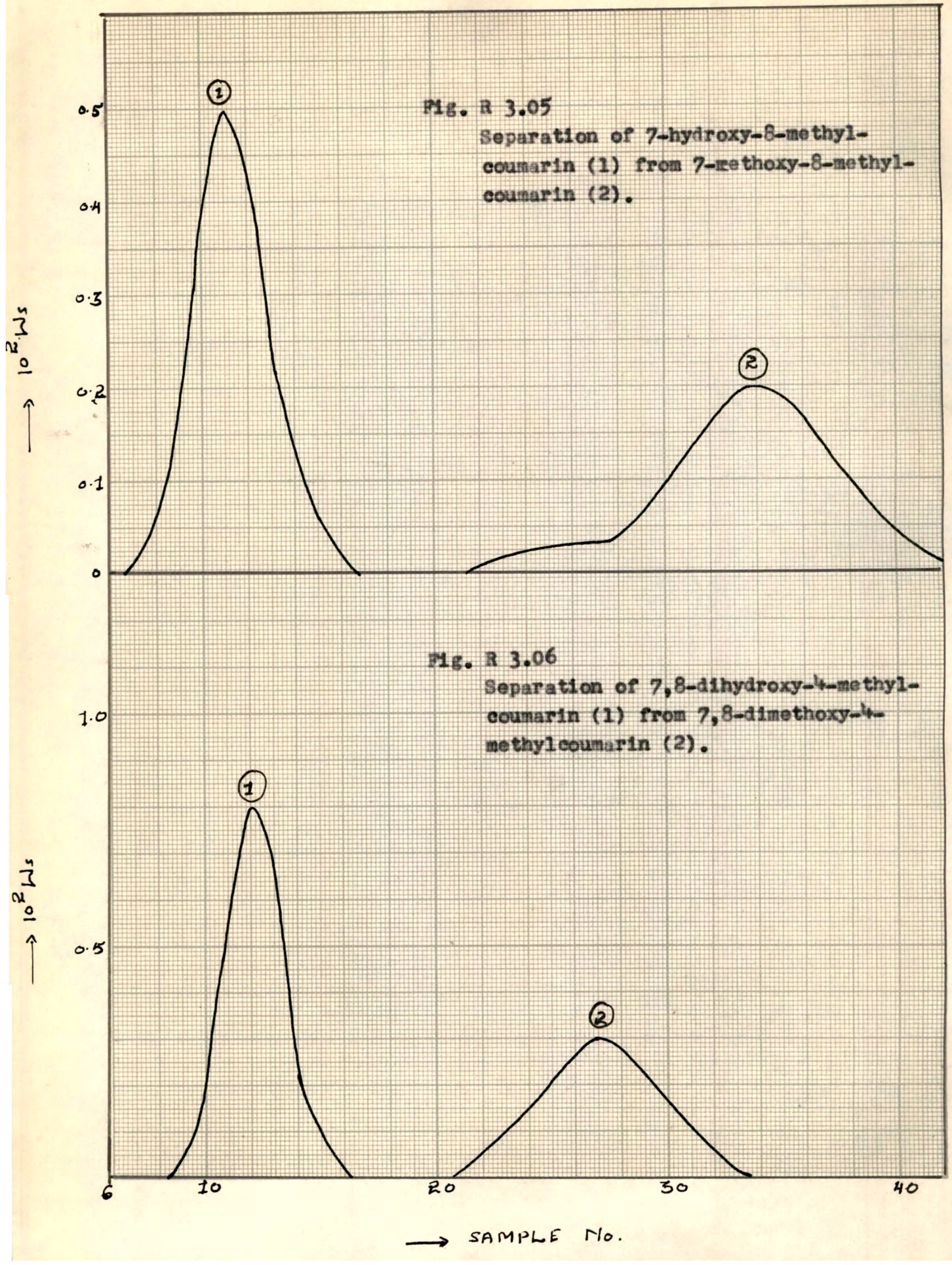


Fig. R 3.05
Separation of 7-hydroxy-8-methylcoumarin (1) from 7-methoxy-8-methylcoumarin (2).

Fig. R 3.06
Separation of 7,8-dihydroxy-4-methylcoumarin (1) from 7,8-dimethoxy-4-methylcoumarin (2).

Table R 3.11

Separation of 7-hydroxy-8-methylcoumarin from 7-methoxy-8-methylcoumarin and 7,8-dihydroxy-4-methylcoumarin from 7,8-dimethoxy-4-methylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound:	7-OH-8-MeI +	7-MeO-8-MeI	7,8-diOH-4-MeI +	7,8-diMeO-4-MeI
10^2W =	2.06	1.85	2.65	1.93
Sample No.	10^2Ws =		10^2Ws =	
v.v.	-	-	-	-
1-8	-	-	-	-
9	-	-	0.04	-
10	-	-	0.19	-
11	-	-	0.54	-
12	-	-	0.80	-
13	-	-	0.66	-
14	-	-	0.31	-
15	-	-	0.09	-
16	-	-	0.02	-
17	0.01	-	--	-
18	0.06	-	-	-
19	0.20	-	-	-
20	0.38	-	-	-
21	0.50	-	-	0.01
22	0.43	-	-	0.05
23	0.25	-	-	0.10
24	0.15	-	-	0.15
25	0.06	-	-	0.22
26	0.02	-	-	0.27
27	-	-	-	0.30
28	-	-	-	0.28
29	-	-	-	0.23
30	-	-	-	0.15
31	-	-	-	0.10
32	-	0.01	-	0.05
33	-	0.02	-	0.02
34	-	0.02	-	-

Table R 3.11 (contd.)

35	-	0.03	-	-
36	-	0.03	-	-
37	-	0.03	-	-
38	-	0.04	-	-
39	-	0.06	-	-
40	-	0.09	-	-
41	-	0.13	-	-
42	-	0.16	-	-
43	-	0.19	-	-
44	-	0.20	-	-
45	-	0.19	-	-
46	-	0.17	-	-
47	-	0.13	-	-
48	-	0.10	-	-
49	-	0.07	-	-
50	-	0.05	-	-
51	-	0.02	-	-
52	-	0.01	-	-
53	-	-	-	-

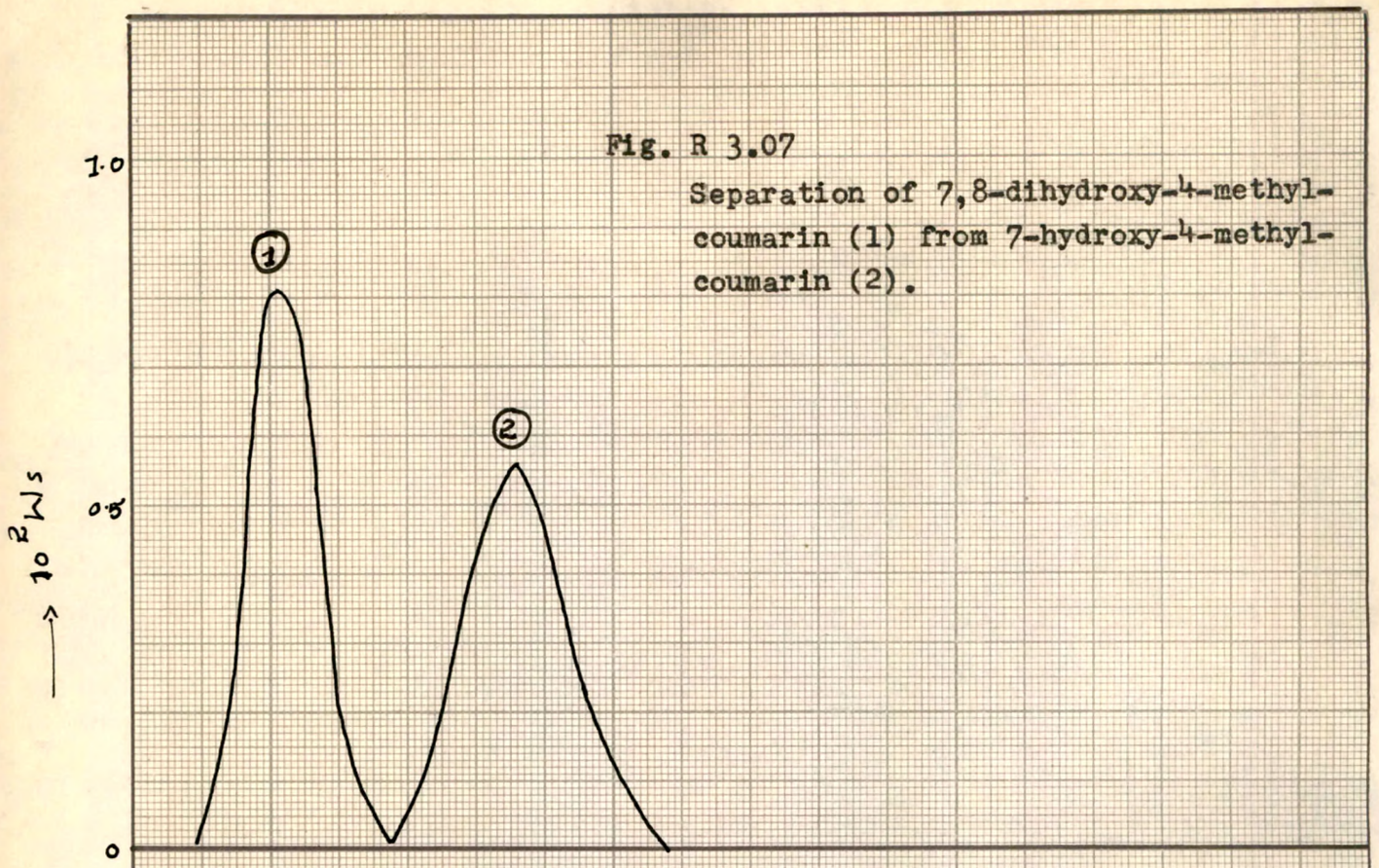


Fig. R 3.07
Separation of 7,8-dihydroxy-4-methyl-coumarin (1) from 7-hydroxy-4-methyl-coumarin (2).

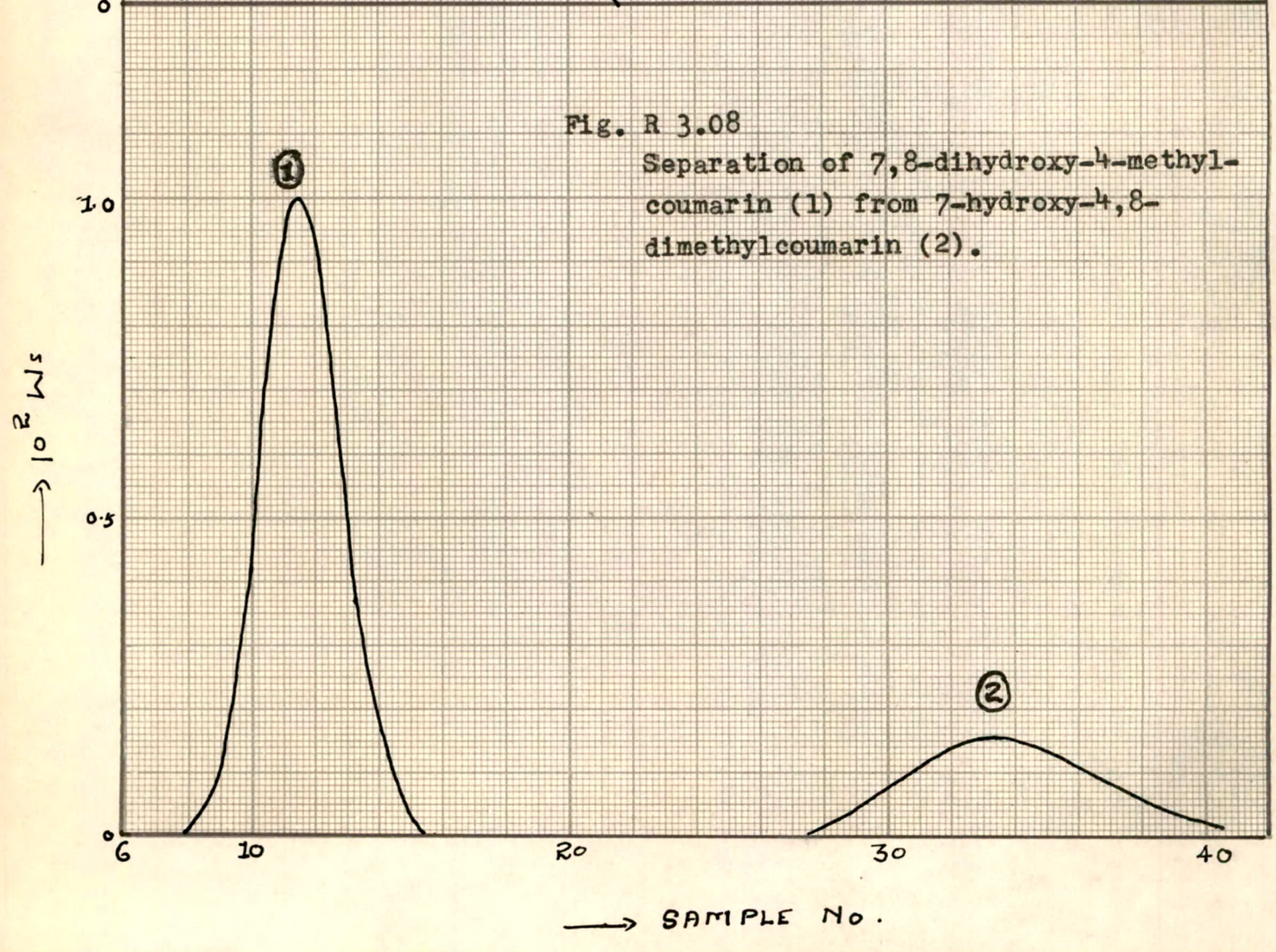


Fig. R 3.08
Separation of 7,8-dihydroxy-4-methyl-coumarin (1) from 7-hydroxy-4,8-dimethylcoumarin (2).

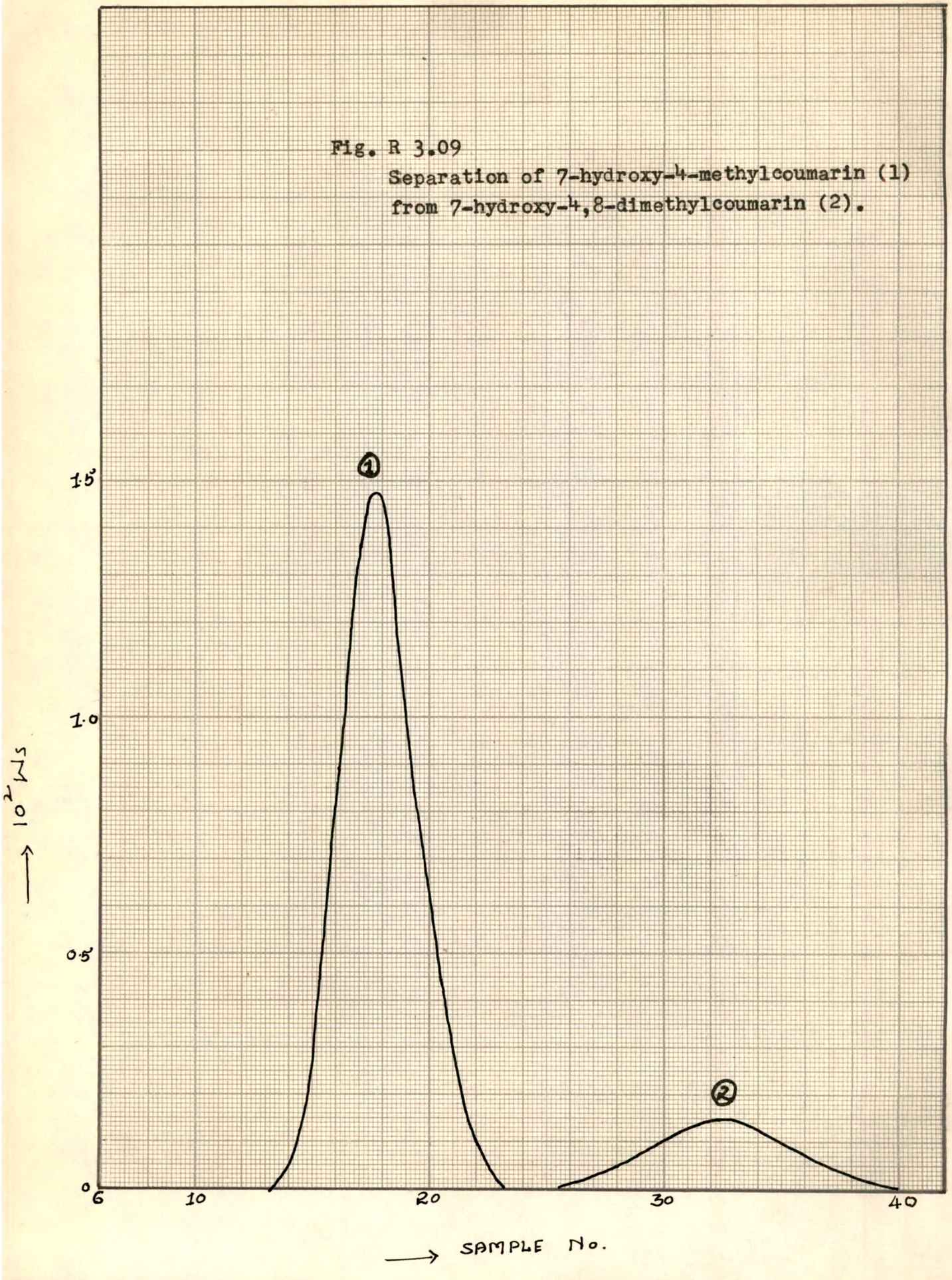
Table R 3.12

Separation of 7,8-dihydroxy-4-methylcoumarin from 7-hydroxy-4-methylcoumarin and from 7-hydroxy-4,8-dimethylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	7,8-diOH-4-MeI	+ 7-OH-4-MeI	7,8-diOH-4-MeI	+ 7-OH-4,8-diMeI
10^2W =	2.09	2.08	3.15	1.12
Sample No.	10^2Ws =		10^2Ws =	
v.v.	-	-	-	-
1-7	-	-	-	-
8	0.02	-	-	-
9	0.27	-	0.08	-
10	0.78	-	0.46	-
11	0.71	-	0.98	-
12	0.26	-	0.94	-
13	0.05	-	0.50	-
14	-	0.04	0.16	-
15	-	0.18	0.03	-
16	-	0.43	-	-
17	-	0.56	-	-
18	-	0.47	-	-
19	-	0.25	-	-
20	-	0.11	-	-
21	-	0.04	-	-
22-27	-	-	-	-
28	-	-	-	0.02
29	-	-	-	0.04
30	-	-	-	0.08
31	-	-	-	0.11
32	-	-	-	0.14
33	-	-	-	0.15
34	-	-	-	0.15
35	-	-	-	0.13
36	-	-	-	0.11
37	-	-	-	0.08
38	-	-	-	0.06
39	-	-	-	0.03
40	-	-	-	0.02
41	-	-	-	-

Fig. R 3.09

Separation of 7-hydroxy-4-methylcoumarin (1) from 7-hydroxy-4,8-dimethylcoumarin (2).



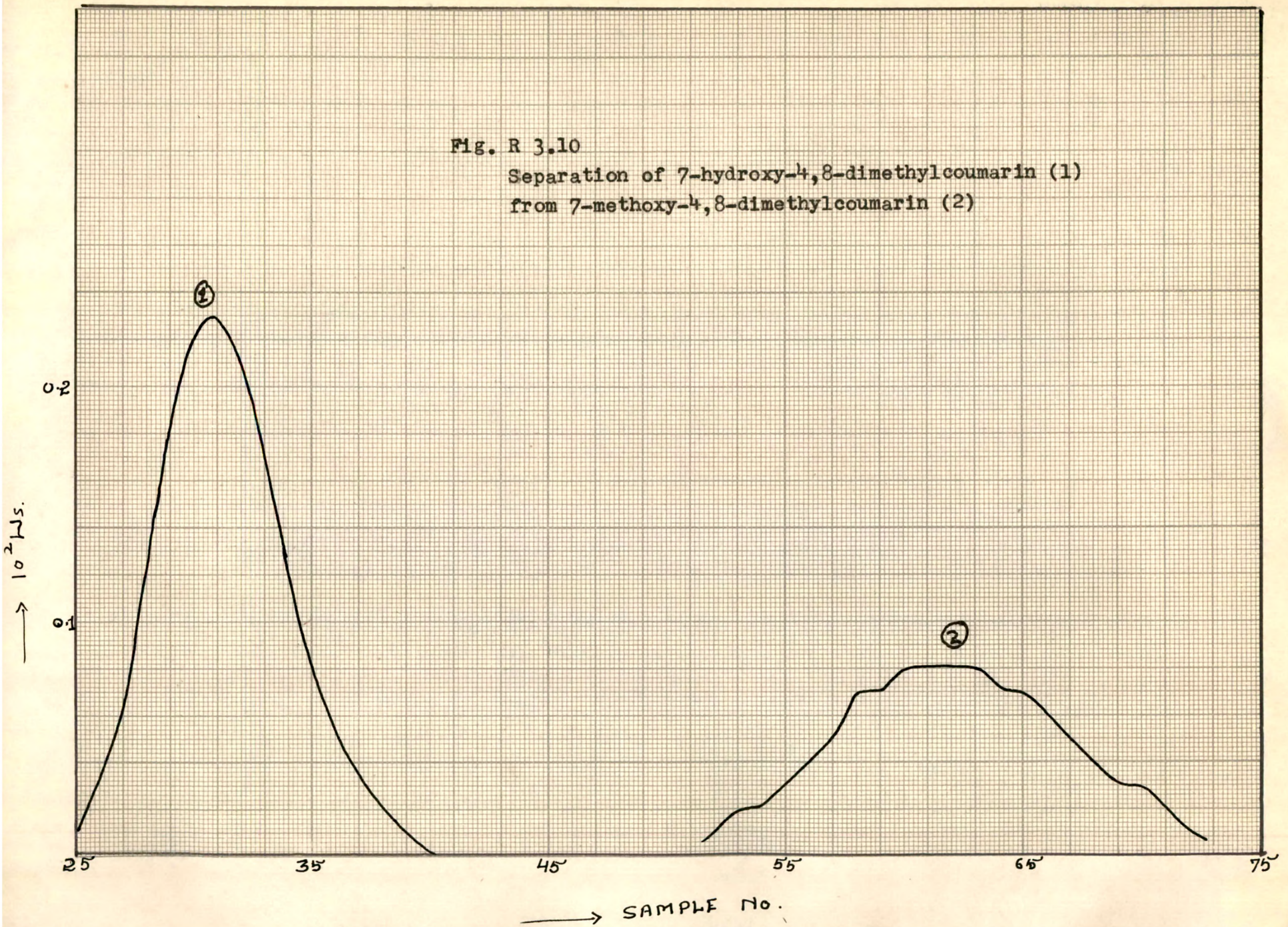


Fig. R 3.10
Separation of 7-hydroxy-4,8-dimethylcoumarin (1)
from 7-methoxy-4,8-dimethylcoumarin (2)

Table R 3.13

Separation of 7-hydroxy-4,8-dimethylcoumarin from 7-hydroxy-4-methylcoumarin and from 7-methoxy-4,8-dimethylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	7-OH-4-MeI +	7-OH-4,8-diMeI	7-OH-4,8-diMeI +	7-MeO-4,8-diMeI
10^2W =	6.03	0.99	1.56	1.01
Sample No.	10^2Ws =		10^2Ws =	
v.v.	-	-	-	-
1-13	-	-	-	-
14	0.04	-	-	-
15	0.31	-	-	-
16	0.76	-	-	-
17	1.34	-	-	-
18	1.46	-	-	-
19	1.10	-	-	-
20	0.64	-	-	-
21	0.27	-	-	-
22	0.10	-	-	-
23	0.01	-	-	-
24	-	-	-	-
25	-	-	0.01	-
26	-	0.01	0.03	-
27	-	0.03	0.06	-
28	-	0.05	0.12	-
29	-	0.07	0.18	-
30	-	0.11	0.22	-
31	-	0.14	0.23	-
32	-	0.14	0.21	-
33	-	0.14	0.17	-
34	-	0.12	0.13	-
35	-	0.10	0.09	-
36	-	0.07	0.05	-
37	-	0.05	0.03	-
38	-	0.03	0.02	-
39	-	0.02	0.01	-

Table R 3.13 (contd.)

40	-	0.01	-	-
41-51	-	-	-	-
52	-	-	-	-
53	-	-	-	0.01
54	-	-	-	0.02
55	-	-	-	0.02
56	-	-	-	0.03
57	-	-	-	0.04
58	-	-	-	0.05
59	-	-	-	0.07
60	-	-	-	0.07
61	-	-	-	0.08
62	-	-	-	0.08
63	-	-	-	0.08
64	-	-	-	0.08
65	-	-	-	0.07
66	-	-	-	0.07
67	-	-	-	0.06
68	-	-	-	0.05
69	-	-	-	0.04
70	-	-	-	0.03
71	-	-	-	0.03
72	-	-	-	0.02
73	-	-	-	0.01
74	-	-	-	-

Fig. R 3.11
Separation of 5,7-dihydroxy-4-methylcoumarin (1) from 5,7-dimethoxy-4-methylcoumarin (2).

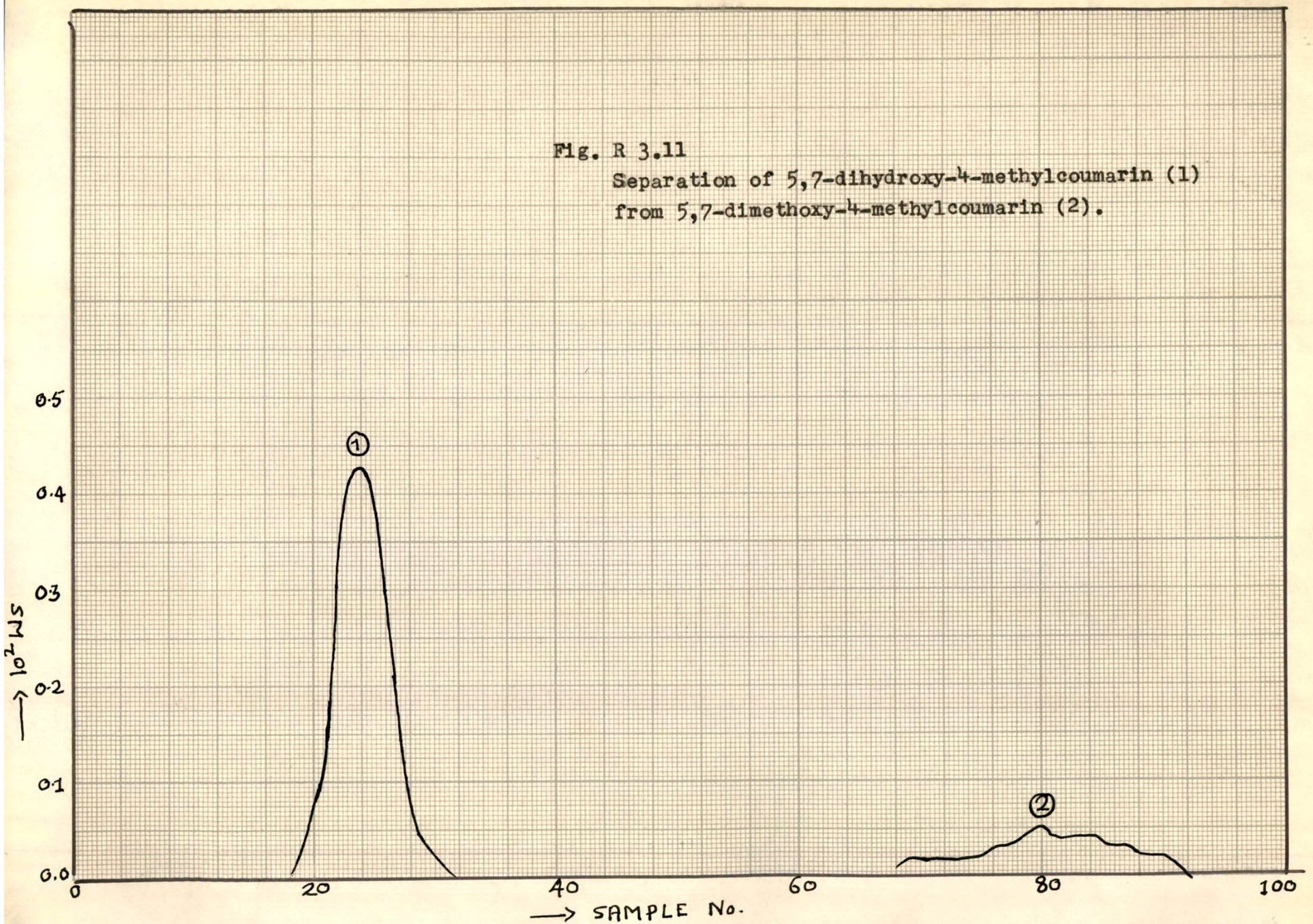


Table R 3.14

Separation of 5,7-dihydroxy-4-methylcoumarin from 5,7-dimethoxy-4-methylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	5,7-diOH-4-MeI	+ 5,7-diMeO-4-MeI
10^2W =	2.56	0.56
Sample No.	10^2Ws	
v.v.	-	-
1-18	-	-
19	0.03	-
20	0.10	-
21	0.17	-
22	0.30	-
23	0.41	-
24	0.43	-
25	0.39	-
26	0.29	-
27	0.20	-
28	0.12	-
29	0.06	-
30	0.04	-
31	0.02	-
32-67	-	-
68	-	0.01
69	-	0.02
70	-	0.02
71	-	0.02
72	-	0.02
73	-	0.02
74	-	0.02
75	-	0.02
76	-	0.03
77	-	0.03
78	-	0.04
79	-	0.04
80	-	0.05
81	-	0.04
82	-	0.04
83	-	0.04
84	-	0.04
85	-	0.04
86	-	0.03
87	-	0.03
88	-	0.02
89	-	0.02
90	-	0.02
91	-	0.01
92	-	0.01
93	-	-

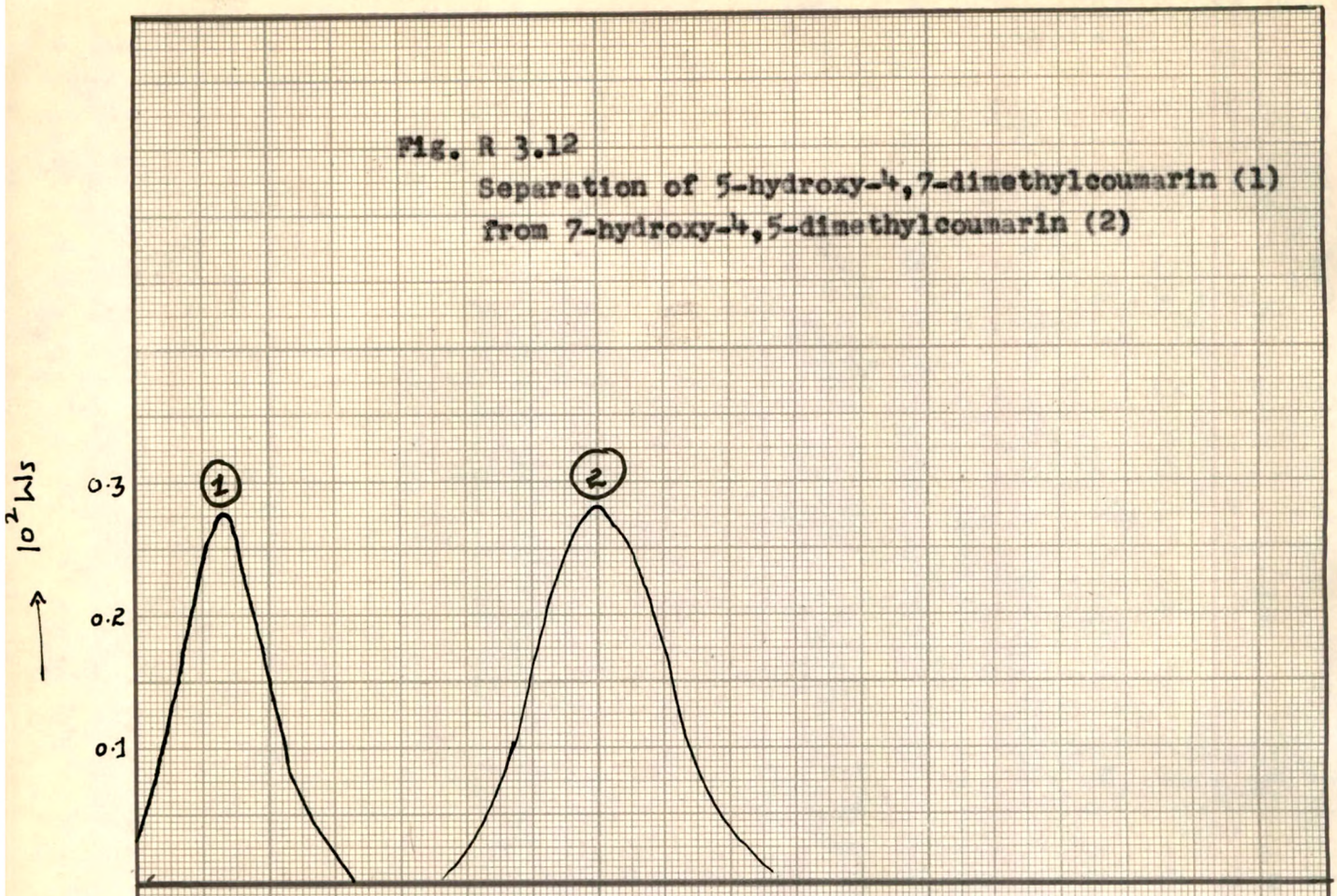


Fig. R 3.12
Separation of 5-hydroxy-4,7-dimethylcoumarin (1) from 7-hydroxy-4,5-dimethylcoumarin (2)

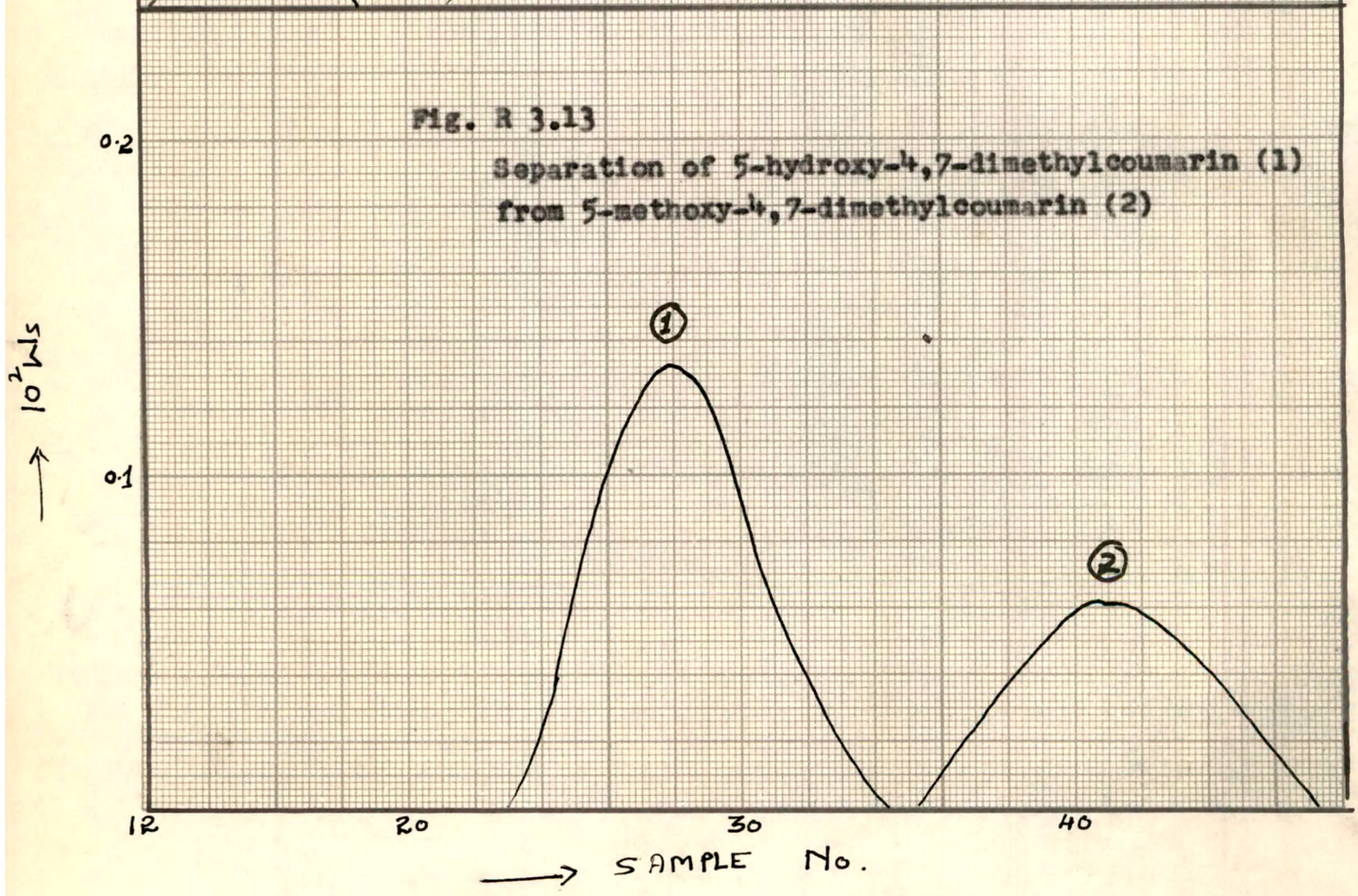


Fig. R 3.13
Separation of 5-hydroxy-4,7-dimethylcoumarin (1) from 5-methoxy-4,7-dimethylcoumarin (2)

Table R 3.15

Separation of 5-hydroxy-4,7-dimethylcoumarin from 7-hydroxy-4,5-dimethylcoumarin on column A with 30 % aqueous methanol as solvent and eluant.

Compound :	5-OH-4,7-diMeI + 7-OH-4,5-diMeI	
10^2W =	0.86	1.37
Sample No.	10^2Ws =	
v.v.	-	-
1-11	-	-
12	0.03	-
13	0.13	-
14	0.24	-
15	0.24	-
16	0.15	-
17	0.06	-
18	0.02	-
19-21	-	-
22	-	0.03
23	-	0.08
24	-	0.17
25	-	0.25
26	-	0.29
27	-	0.25
28	-	0.17
29	-	0.09
30	-	0.04
31	-	0.01
32	-	-

Table R 3.16

Separation of 5-hydroxy-4,7-dimethylcoumarin from 5-methoxy-4,7-dimethylcoumarin on column A with 20 % aqueous methanol as solvent and eluant.

Compound	5-OH-4,7-diMeI +	5-MeO-4,7-diMeI
10^2W =	0.79	0.51
Sample No.	10^2Ws =	
v.v.	-	-
1-23	-	-
24	0.03	-
25	0.06	-
26	0.10	-
27	0.13	-
28	0.14	-
29	0.12	-
30	0.09	-
31	0.06	-
32	0.04	-
33	0.02	-
34-36	-	-
37	-	0.03
38	-	0.04
39	-	0.05
40	-	0.06
41	-	0.06
42	-	0.06
43	-	0.06
44	-	0.05
45	-	0.05
46	-	0.03
47	-	0.02
48	-	-

Table R 3.17

Column elution of 7-hydroxy-4-methylcoumarin-8-carboxylic acid and 7-hydroxy-4-methylcoumarin-6-carboxylic acid on column A with N/100 aqueous hydrochloric acid as solvent and eluent.

Compound	7-OH-4-MeI-8-COOH	7-OH-4-MeI-6-COOH
10^2W =	9.61	6.92
Sample No.	10^2Ws =	
v.v.	-	-
1-8	-	-
9	0.27	-
10	0.41	-
11	1.03	-
12	2.04	-
13	2.49	-
14	1.72	-
15	0.95	0.13
16	0.40	0.27
17	0.17	0.58
18	0.13	0.96
19	-	1.18
20	-	1.18
21	-	0.95
22	-	0.84
23	-	0.53
24	-	0.18
25	-	0.12
26	-	-

Table R 3.18

Column elution of 7-hydroxy-4-methylcoumarin-8-carboxylic acid and 7-hydroxy-4-methylcoumarin-6-carboxylic acid on column A with N/10 aqueous hydrochloric acid as solvent and eluant.

Compound :	7-OH-4-MeI-8-COOH	7-OH-4-MeI-6-COOH
10^2W =	7.88	7.40
Sample No.	10^2Ws =	
v.v.	-	-
1-13	-	-
14	0.24	-
15	0.58	-
16	1.11	-
17	1.53	-
18	1.52	-
19	1.22	-
20	0.85	-
21	0.45	0.18
22	0.38	0.26
23	-	0.34
24	-	0.60
25	-	0.92
26	-	1.10
27	-	1.10
28	-	0.95
29	-	0.72
30	-	0.52
31	-	0.28
32	-	0.20
33	-	0.15
34	-	0.08
35	-	-

Table R 3.19

Column elution of 7-hydroxy-4-methylcoumarin-8-carboxylic acid and 7-hydroxy-4-methylcoumarin-6-carboxylic acid on column A with N/2 aqueous hydrochloric acid as solvent and eluant.

Compound :	7-OH-4-MeI-8-COOH	7-OH-4-MeI-6-COOH
10^2W =	4.53	3.82
Sample No.	10^2Ws =	
v.v.	-	-
1-14	-	-
15	0.09	-
16	0.35	-
17	0.71	-
18	0.97	-
19	1.29	-
20	0.60	-
21	0.36	-
22	0.16	-
23	-	0.15
24	-	0.26
25	-	0.42
26	-	0.57
27	-	0.66
28	-	0.60
29	-	0.50
30	-	0.33
31	-	0.24
32	-	0.09
33	-	-

Table R 3.20

Column elution of 7-hydroxy-4-methylcoumarin-8-carboxylic acid and 7-hydroxy-4-methylcoumarin-6-carboxylic acid on column B with N/100 aqueous hydrochloric acid as solvent and eluant.

Compound :	7-OH-4-MeI-8-COOH	7-OH-4-MeI-6-COOH
10^2W =	7.72	6.22
Sample No.	10^2Ws =	
v.v.	-	-
1-13	-	-
14	0.12	-
15	0.33	-
16	0.57	-
17	1.28	-
18	2.08	-
19	1.83	-
20	0.99	-
21	0.52	-
22-25	-	-
26	-	0.13
27	-	0.39
28	-	0.86
29	-	1.28
30	-	1.39
31	-	1.07
32	-	0.64
33	-	0.27
34	-	0.09
35	-	-

Fig. R 3.14

Separation of 7-hydroxy-4-methylcoumarin-8-carboxylic acid (1) from 7-hydroxy-4-methylcoumarin-6-carboxylic acid (2).

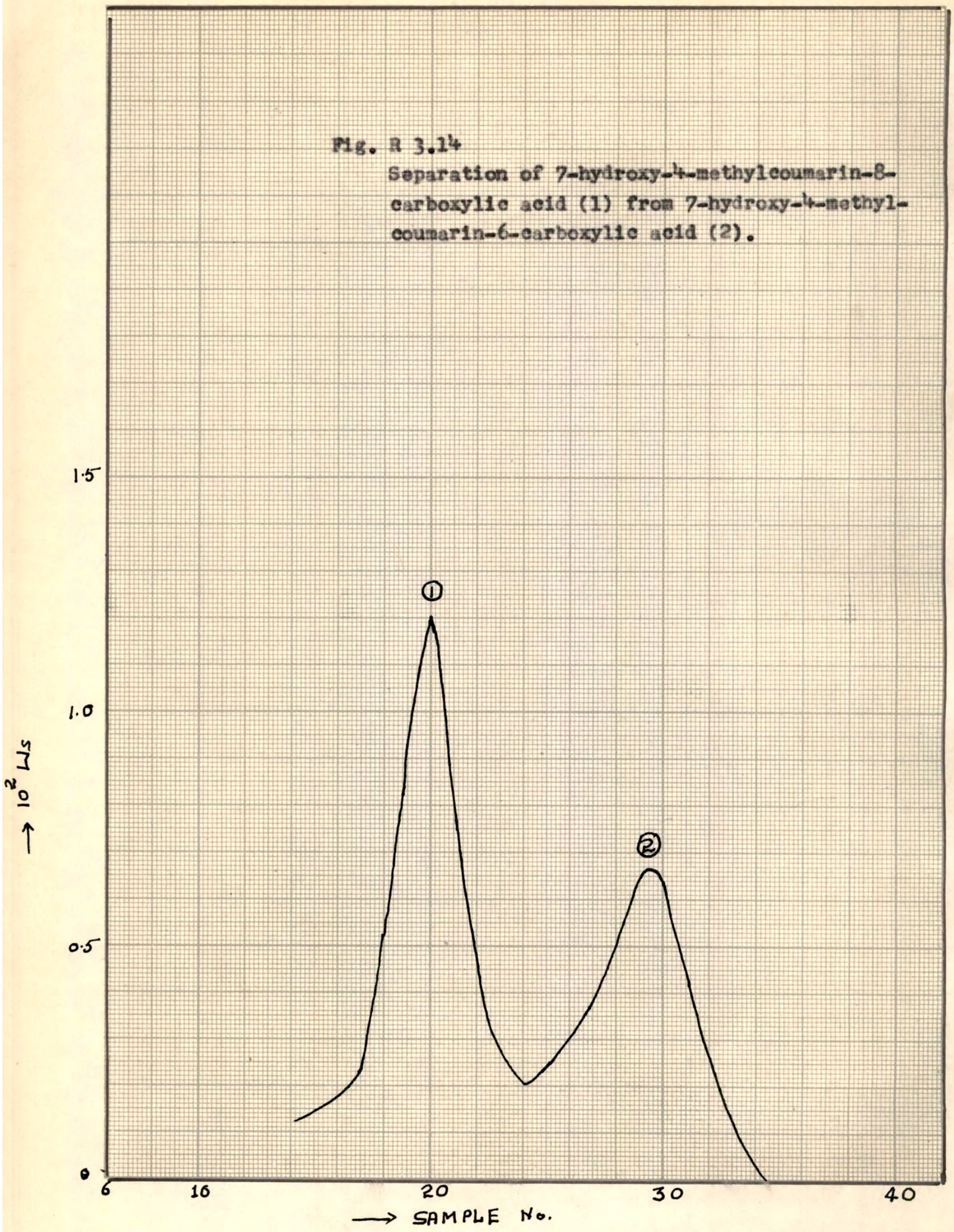


Table R 3.21

Separation of 7-hydroxy-4-methylcoumarin-8-carboxylic acid from 7-hydroxy-4-methylcoumarin-6-carboxylic acid on column B with N/100 aqueous hydrochloric acid as solvent and eluent.

Compound :	7-OH-4-MeI-8-COOH +	7-OH-4-MeI-6-COOH
10^2W =	4.77	3.38
Sample No.	10^2Ws =	
v.v.	-	-
1-13	-	-
14	0.13	-
15	0.15	-
16	0.19	-
17	0.23	-
18	0.51	-
19	0.86	-
20	1.20	-
21	0.86	-
22	0.34	-
23	0.30	-
24	-	-
25	-	0.19
26	-	0.21
27	-	0.31
28	-	0.51
29	-	0.65
30	-	0.64
31	-	0.45
32	-	0.29
33	-	0.13
34	-	-

Table R 3.22

Separation of 7-hydroxy-4-methylcoumarin-8-carboxylic acid from 7-hydroxy-4-methylcoumarin-6-carboxylic acid on column B in N/100 aqueous hydrochloric acid, eluting first compound with N/100 aqueous hydrochloric acid and the second with water.

Compound :	7-OH-4-MeI-8-COOH +	7-OH-4-MeI-6-COOH
10^2W =	4.20	3.81
Sample No.	10^2Ws =	
Eluant : N/100 HCl		
v.v.	-	-
1-15	-	-
16	0.19	-
17	0.30	-
18	0.48	-
19	0.94	-
20	1.08	-
21	0.78	-
22	0.32	-
23	0.11	-
24	-	-
Eluant : water		
25	-	0.16
26	-	3.08
27	-	0.30
28	-	0.27
29	-	-

Table R 3.23(a)

Column elution of 4,7-dihydroxycoumarin on column A using water as solvent and eluant.

10^2W =	4.60
Sample No.	10^2Ws =
v.v.	-
1-14	-
15	0.01
16	0.04
17	0.12
18	0.24
19	0.38
20	0.49
21	0.52
22	0.50
23	0.44
24	0.35
25	0.26
26	0.18
27	0.12
28	0.07
29	0.04
30	0.02
31	-
10^2W_F =	3.78
P_F =	82.0

Table R 3.23(b)

Column elution of 4,7-dihydroxycoumarin on column A with 10 % methanol in N/10 hydrochloric acid as solvent and eluant.

10^2W =	3.73
Sample No.	10^2Ws =
v.v.	-
1-7	-
8	0.03
9	0.04
10	0.05
11	0.05
12	0.07
13	0.20
14	0.53
15	0.82
16	0.74
17	0.43
18	0.19
19	0.06
20	0.02
21	0.01
22	-
10^2W_F =	3.29
P_F =	88.0

Table R 3.23(c)

Column elution of 4,7-dihydroxycoumarin on column A with 30 % aqueous methanol as solvent and eluant.

10^2W =	5.40
Sample No.	10^2Ws =
v.v.	-
1-2	-
3	0.01
4	0.05
5	0.44
6	1.42
7	1.69
8	0.88
9	0.23
10	0.07
11	0.08
12	0.11
13	0.12
14	0.10
15	0.07
16	0.04
17	0.02
18	0.01
19	-

Fig. R 3.15

Column elution of 4,7-dihydroxycoumarin .

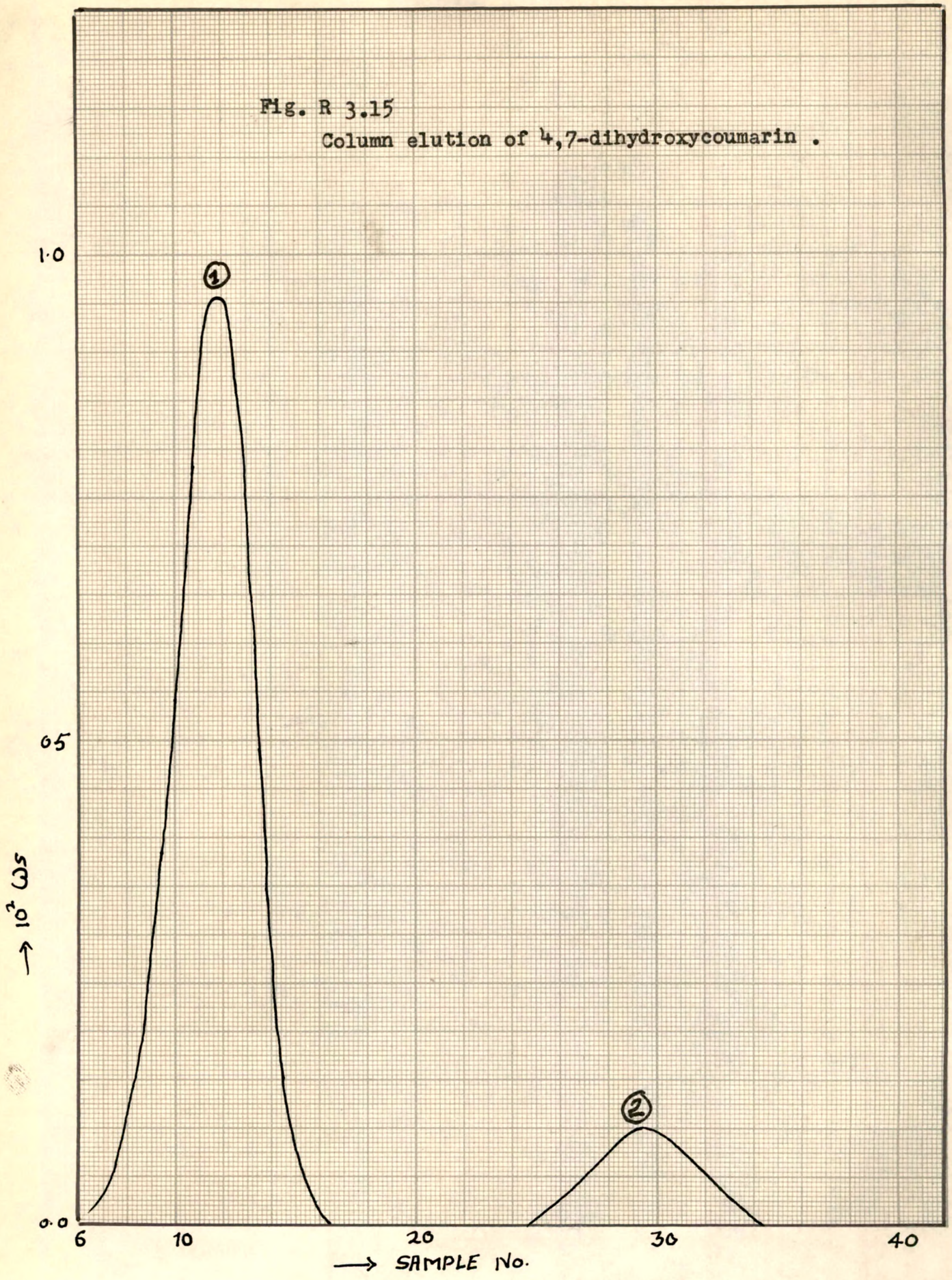


Table R 3.24

Column elution of 4,7-dihydroxycoumarin on column A using 10 % aqueous methanol as solvent and eluting the first band with 10 % aqueous methanol and second band with 30 % aqueous methanol.

10^2W =	4.73
Sample No.	10^2Ws =
v.v.	-
1-7	-
8	0.01
9	0.04
10	0.13
11	0.31
12	0.56
13	0.86
14	0.96
15	0.73
16	0.32
17	0.09
18	0.02
19-21	-
10^2W_F =	4.03
P_F =	85.0

The eluant was changed to 30 % aqueous methanol.

22-25	-
26	0.03
27	0.05
28	0.08
29	0.10
30	0.10
31	0.08
32	0.05
33	0.03
34	0.01
35	-

Table R 3.25

Column elution of 4-hydroxy-3-methylcoumarin and 4-hydroxy-6-methylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound:	4-OH-3-MeI	4-OH-6-MeI
10^2W =	4.86	3.58
Sample No.	10^2Ws =	
v.v.	-	-
1-9	-	-
10	0.04	-
11	0.15	-
12	0.60	-
13	1.17	-
14	1.40	-
15	0.96	-
16	0.40	-
17	0.10	-
18	0.04	-
19	-	0.09
20	-	0.15
21	-	0.24
22	-	0.34
23	-	0.42
24	-	0.49
25	-	0.50
26	-	0.44
27	-	0.34
28	-	0.24
29	-	0.16
30	-	0.11
31	-	0.06
32	-	-
10^2W_F =	4.86	3.58
P_F =	100.0	100.0

Table R 3.26

Column elution of 4-hydroxy-3-methylcoumarin and 4-hydroxy-6-methylcoumarin on column A with 10 % methanol in N/100 hydrochloric acid as solvent and eluant.

Compound :	4-OH-3-MeI	4-OH-6-MeI
10^2W =	5.25	6.21
Sample No.	10^2Ws =	
v.v.	-	-
1-12	-	-
13	0.09	-
14	0.34	-
15	0.75	-
16	1.11	-
17	1.17	-
18	0.92	-
19	0.47	-
20	0.25	-
21	0.11	0.05
22	0.04	0.08
23	-	0.11
24	-	0.22
25	-	0.44
26	-	0.66
27	-	0.82
28	-	0.85
29	-	0.77
30	-	0.64
31	-	0.46
32	-	0.30
33	-	0.20
34	-	0.11
35	-	0.05
36	-	-
10^2W_F =	5.26	6.21
P_F =	100.0	100.0

Table R 3.27

Column elution of 4-hydroxycoumarins on column A with 10 % aqueous methanol in N/10 hydrochloric acid as solvent and eluant.

Compound :	4-OHI	4-OH-3-MeI	4-OH-6-MeI	4-OH-7-MeOI
10^2W =	3.94	3.81	3.78	3.49
Sample No.		10^2Ws =		
v.v.	-	-	-	-
1-11	-	-	-	-
12	0.05	-	-	-
13	0.22	-	-	0.02
14	0.74	-	-	0.02
15	1.13	-	-	0.02
16	0.88	-	-	0.03
17	0.40	0.08	-	0.03
18	0.12	0.34	-	0.03
19	0.03	0.76	-	0.04
20		1.00	-	0.04
21		0.82	-	0.05
22		0.49	-	0.09
23		0.25	-	0.13
24		0.07	-	0.22
25		-	-	0.35
26		-	-	0.47
27		-	0.04	0.50
28		-	0.09	0.46
29		-	0.18	0.37
30		-	0.31	0.25
31		-	0.45	0.15
32		-	0.54	0.09
33		-	0.60	0.04
34		-	0.52	0.02
35		-	0.40	-
36		-	0.28	-
37		-	0.18	-
38		-	0.10	-
39		-	0.06	-
40		-	0.03	-
41		-	-	-
10^2W_F =	3.54	3.81	3.78	3.42
P_F =	90.0	100.0	100.0	98.0

Table R 3.28

Column elution of some 4-hydroxycoumarins on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	4,6-diOH	4-OH-5-MeOI	4-OH-6-MeOI
10^2W =	3.02	3.22	5.67
Sample No.		10^2Ws =	
v.v.	-	-	-
1-6	-	-	-
7	0.02	-	-
8	0.09	-	-
9	0.27	-	-
10	0.53	-	-
11	0.75	-	-
12	0.68	-	-
13	0.33	-	0.01
14	0.09	-	0.04
15	0.04	0.05	0.09
16	0.02	0.15	0.16
17		0.39	0.27
18		0.57	0.39
19		0.60	0.54
20		0.51	0.70
21		0.34	0.86
22		0.19	0.87
23		0.09	0.65
24		0.03	0.19
25			0.04
10^2Ws =	2.82	2.92	4.81
P_F =	93.0	91.0	85.0

Table R 3.29

Column elution of some 4-hydroxycoumarins on column A with 10 % methanol in N/100 hydrochloric acid as solvent and eluant.

Compound :	4,5-diOHI	4,6-diOHI	4-OH-5-MeOI	4-OH-6-MeOI
10^2W =	3.10	3.16	4.50	2.53
Sample No.		10^2Ws =		
v.v.	-	-	-	-
1-8	-	-	-	-
9	0.02	-	-	-
10	0.15	-	-	-
11	0.47	-	-	-
12	0.70	0.01	-	-
13	0.58	0.06	-	-
14	0.31	0.20	-	-
15	0.12	0.41	-	-
16	0.04	0.57	-	-
17	0.02	0.59	0.05	-
18		0.46	0.19	-
19		0.29	0.45	-
20		0.16	0.74	-
21		0.08	0.87	-
22		0.04	0.78	-
23		0.03	0.56	-
24		0.02	0.34	-
25			0.17	0.02
26			0.07	0.04
27			0.03	0.07
28				0.11
29				0.16
30				0.19
31				0.22
32				0.24
33				0.24
34				0.22
35				0.20

Table R 3.29 (contd.)

36				0.17
37				0.14
38				0.11
39				0.09
40				0.06
41				0.05
42				0.03
43				0.02
$10^2 W_F$ =	2.43	2.92	4.25	2.38
P_F =	78.0	92.0	94.0	94.0

Table R 3.30

Column elution of some 4-hydroxycoumarins on column A with 10 % methanol in N/10 hydrochloric acid as solvent and eluant

Compound :	4,5-diOHI	4,6-diOHI	4-OH-5-MeOI	4-OH-6-MeOI
10^2W =	4.21	3.12	3.65	1.70
Sample No.		10^2Ws =		
v.v.	-	-	-	-
1-10	-	-	-	-
11	0.02	-	-	-
12	0.05	0.02	-	-
13	0.20	0.07	-	-
14	0.49	0.21	-	-
15	0.71	0.43	-	-
16	0.70	0.60	0.02	-
17	0.50	0.60	0.08	-
18	0.28	0.47	0.21	-
19	0.14	0.28	0.41	-
20	0.06	0.15	0.58	-
21	0.04	0.07	0.64	-
22	0.02	0.04	0.58	-
23	0.02	0.03	0.54	-
24	0.02	0.03	0.29	-
25		0.02	0.17	-
26		0.02	0.09	-
27		0.02	0.04	0.02
28		-	0.02	0.05
29		-	-	0.09
30		-	-	0.14
31		-	-	0.18
32		-	-	0.21
33		-	-	0.21
34		-	-	0.20
35		-	-	0.17
36		-	-	0.13
37		-	-	0.10
38		-	-	0.07
39		-	-	0.05
40		-	-	0.03
41		-	-	0.02
42		-	-	0.01
43		-	-	-
10^2W_F =	3.25	3.06	3.57	1.68
P_F =	77.0	98.0	98.0	99.0

Fig. R 3.16

Separation of 4-hydroxy-3-methylcoumarin (1) from 4-hydroxy-6-methylcoumarin (2).

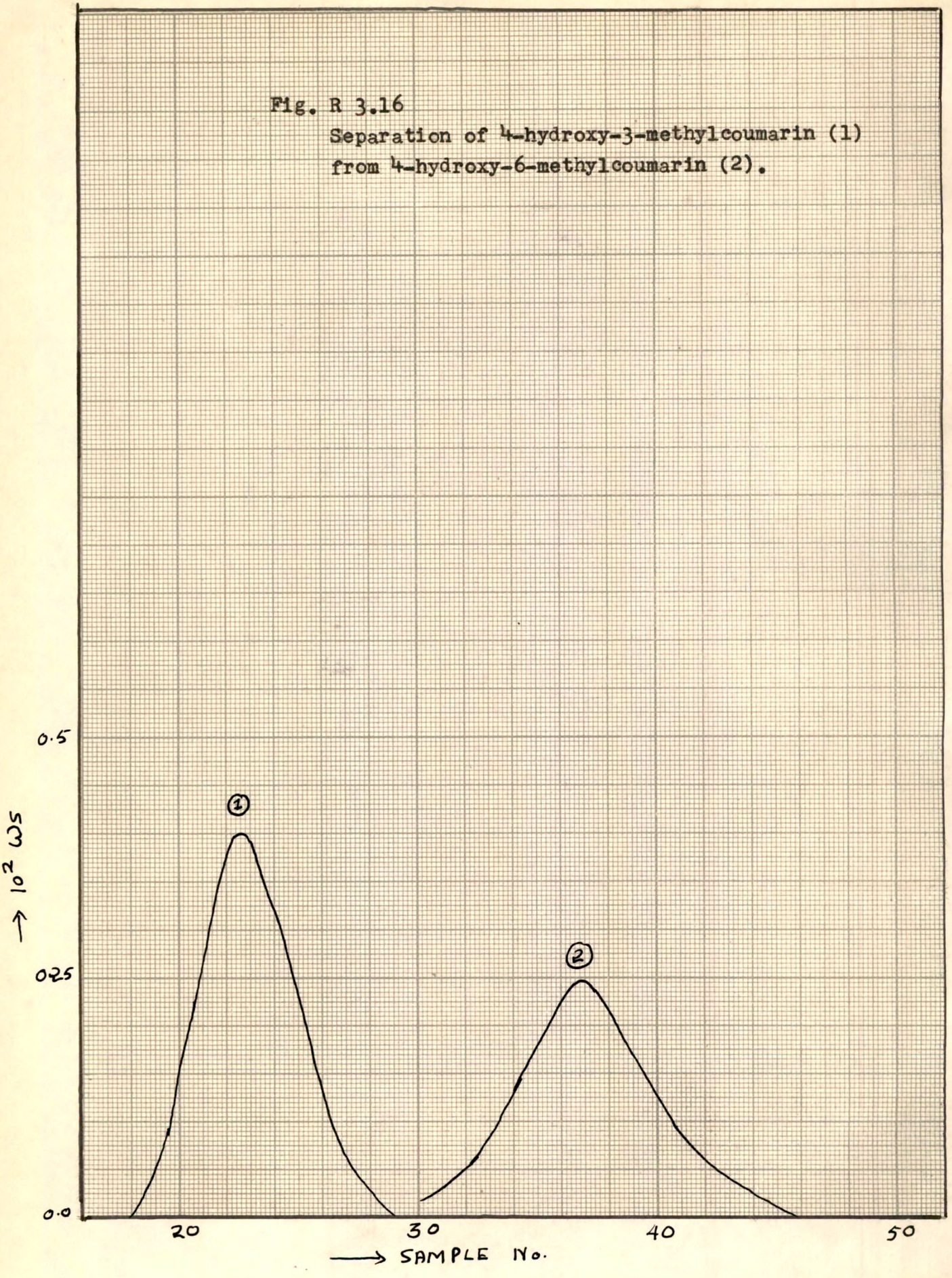


Table R 3.31

Separation of 4-hydroxy-3-methylcoumarin from 4-hydroxy-6-methylcoumarin on column A with 10 % methanol in N/10 hydrochloric acid as solvent and eluant.

Compound :	4-OH-3-MeI	+ 4-OH-6-MeI
10^2W =	2.01	2.03
Sample No.	10^2Ws =	
v.v.	-	-
1-18	-	-
19	0.05	-
20	0.14	-
21	0.27	-
22	0.38	-
23	0.39	-
24	0.32	-
25	0.24	-
26	0.13	-
27	0.06	-
28	0.03	-
29	-	0.02
30	-	0.03
31	-	0.05
32	-	0.08
33	-	0.13
34	-	0.18
35	-	0.23
36	-	0.25
37	-	0.25
38	-	0.23
39	-	0.19
40	-	0.14
41	-	0.10
42	-	0.07
43	-	0.04
44	-	0.02
45	-	-

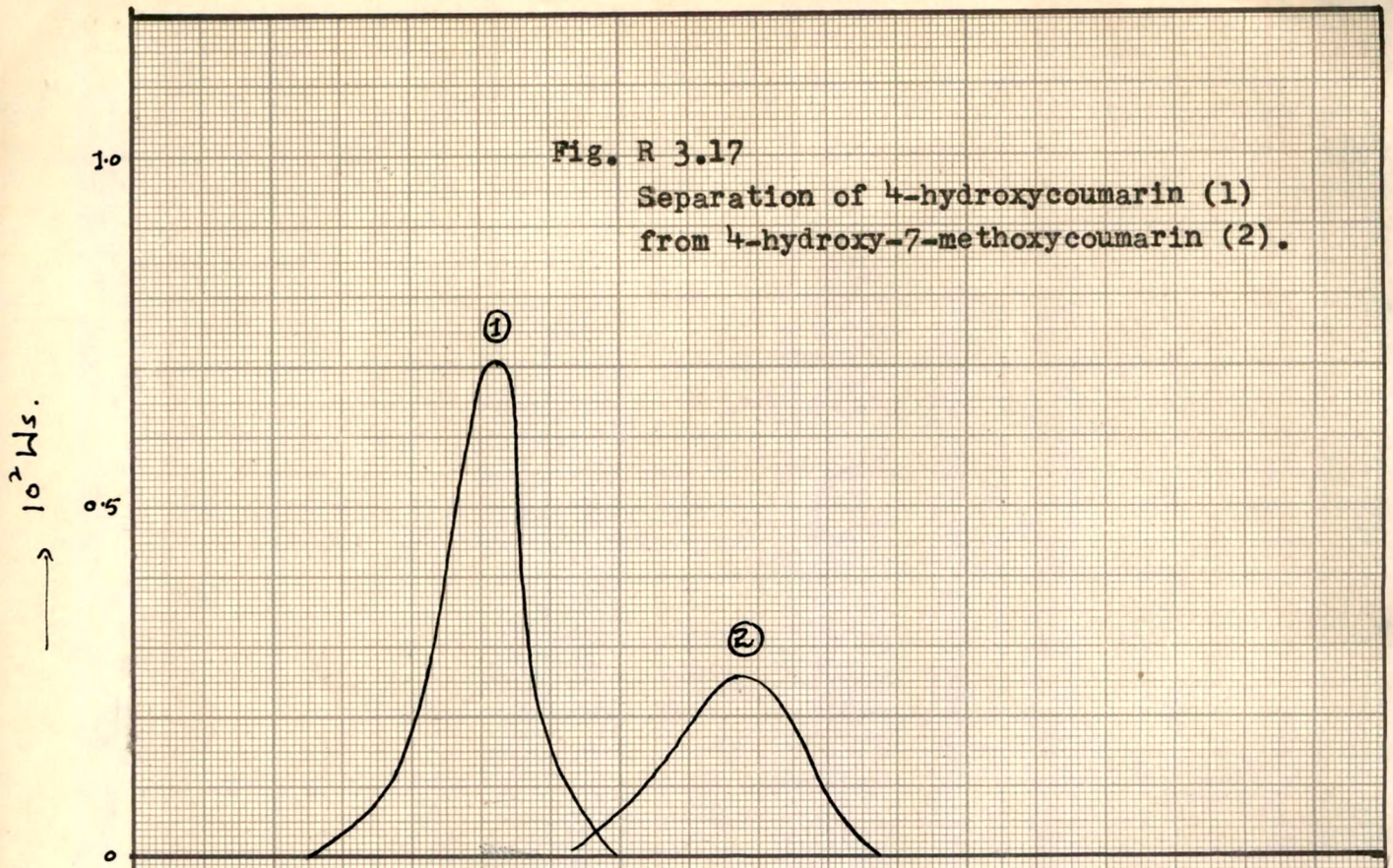


Fig. R 3.17

Separation of 4-hydroxycoumarin (1) from 4-hydroxy-7-methoxycoumarin (2).

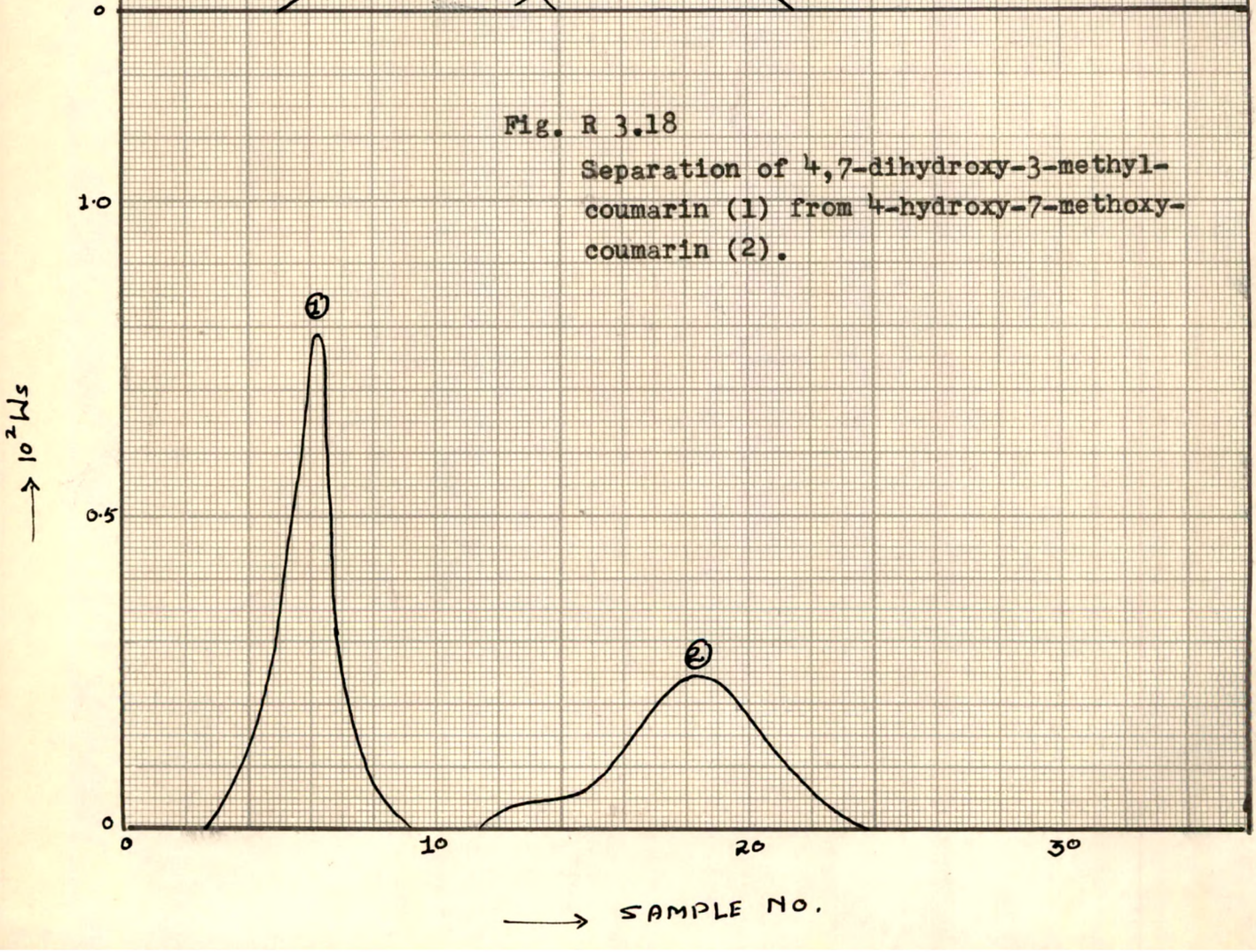


Fig. R 3.18

Separation of 4,7-dihydroxy-3-methylcoumarin (1) from 4-hydroxy-7-methoxycoumarin (2).

Table R 3.32

Separation of 4-hydroxy-7-methoxycoumarin from 4-hydroxycoumarin and from 4,7-dihydroxy-3-methylcoumarin on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	4-OHI +	4-OH-7-MeOI	4,7-diOH-3-MeI +	4-OH-7-MeOI
10^2W =	2.41	1.73	1.80	1.60
Sample No.	10^2Ws =		10^2Ws =	
v.v.	-	-	-	-
1	-	-	-	-
2	-	-	0.13	-
3	-	-	0.42	-
4	-	-	0.76	-
5	-	-	0.49	-
6	0.04	-	0.03	-
7	0.07	-	-	-
8	0.21	-	-	-
9	0.42	-	-	-
10	0.69	-	-	-
11	0.65	-	-	-
12	0.15	-	-	0.02
13	0.06	0.02	-	0.04
14	-	0.07	-	0.04
15	-	0.10	-	0.06
16	-	0.16	-	0.12
17	-	0.25	-	0.20
18	-	0.25	-	0.24
19	-	0.25	-	0.24
20	-	0.20	-	0.18
21	-	0.08	-	0.11
22	-	0.03	-	0.05
23	-	0.01	-	0.02
24	-	-	-	-

Table R 3.33

Column elution of ortho-, meta- and para-nitrotoluenes on column A with water as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U =	35.49	23.39	4.02
Sample No.		10^2Us =	
v.v.	-	-	-
1-44	-	-	-
45	0.05	-	-
46	0.05	-	-
47	0.07	-	-
48	0.11	-	0.02
49	0.20	-	0.03
50	0.33	-	0.04
51	0.61	0.02	0.04
52	0.87	0.04	0.05
53	1.29	0.06	0.06
54	1.78	0.06	0.07
55	2.28	0.10	0.11
56	2.70	0.15	0.14
57	2.88	0.20	0.17
58	3.01	0.31	0.20
59	2.93	0.42	0.25
60	2.80	0.64	0.28
61	2.55	1.23	0.30
62	2.27	1.26	0.31
63	1.94	1.34	0.32
64	1.61	1.52	0.28
65	1.33	1.58	0.26
66	1.07	1.64	0.24
67	0.84	1.70	0.22
68	0.66	1.67	0.16
69	0.51	1.50	0.13
70	0.39	1.32	0.10
71	0.29	1.24	0.08
72	0.23	1.07	0.05

Table R 3.33 (contd.)

73	0.17	0.90	0.04
74	0.13	0.75	0.04
75	0.13	0.59	0.03
76	0.11	0.45	-
77	0.09	0.36	-
78	0.06	0.28	-
79	0.05	0.24	-
80	-	0.16	-
81	-	0.14	-
82	-	0.11	-
83	-	0.09	-
84	-	0.08	-
85	-	0.05	-
86	-	0.05	-
87	-	0.04	-
88	-	0.03	-
89	-	-	-

Table R 3.34

Column elution of ortho-, meta- and para-nitrotoluenes on column A with 10 % aqueous methanol as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U	11.65	9.10	5.45
Sample No.		10^2Us =	
v.v.	-	-	-
1-36	-	-	-
37	0.04	-	-
38	0.07	-	-
39	0.14	-	0.02
40	0.26	-	0.03
41	0.44	0.02	0.06
42	0.66	0.04	0.09
43	0.97	0.07	0.16
44	1.08	0.13	0.25
45	1.41	0.21	0.35
46	1.45	0.32	0.47
47	1.36	0.46	0.56
48	1.17	0.63	0.62
49	0.93	0.78	0.64
50	0.68	0.90	0.57
51	0.47	0.97	0.49
52	0.31	0.94	0.38
53	0.20	0.91	0.27
54	0.11	0.74	0.20
55	0.04	0.59	0.12
56	-	0.46	0.08
57	-	0.34	0.04
58	-	0.22	0.03
59	-	0.15	0.02
60	-	0.10	-
61	-	0.06	-
62	-	0.04	-
63	-	0.02	-
64	-	-	-

Table R 3.35

Column elution of ortho-, meta- and para-nitrotoluenes on column A with 10 % methanol in N/100 hydrochloric acid as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U =	9.82	9.18	4.93
Sample No.		10^2Us =	
v.v.	-	-	-
1-37	-	-	-
38	0.04	-	-
39	0.10	-	-
40	0.20	-	0.02
41	0.35	-	0.03
42	0.54	-	0.06
43	0.79	0.03	0.10
44	1.00	0.06	0.16
45	1.14	0.11	0.24
46	1.17	0.20	0.34
47	1.10	0.32	0.44
48	0.94	0.44	0.52
49	0.75	0.66	0.54
50	0.56	0.80	0.55
51	0.40	0.93	0.49
52	0.27	0.97	0.42
53	0.17	0.95	0.33
54	0.11	0.88	0.24
55	0.07	0.74	0.17
56	0.05	0.60	0.12
57	0.04	0.46	0.08
58	0.03	0.34	0.05
59	-	0.24	0.04
60	-	0.17	0.03
61	-	0.12	0.02
62	-	0.09	-
63	-	0.05	-
64	-	0.02	-
65	-	-	-

Table R 3.36

Column elution of ortho-, meta- and para-nitrotoluenes on column A with 10 % methanol in N/10 hydrochloric acid as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U =	10.37	9.78	6.82
Sample No.		10^2Us =	
v.v.	-	-	-
1-38	-	-	-
39	0.04	-	-
40	0.08	-	0.03
41	0.14	-	0.05
42	0.25	0.03	0.09
43	0.39	0.04	0.15
44	0.58	0.07	0.26
45	0.79	0.12	0.40
46	0.96	0.19	0.54
47	1.09	0.31	0.67
48	1.17	0.45	0.77
49	1.09	0.63	0.78
50	0.96	0.80	0.74
51	0.79	0.93	0.64
52	0.62	0.99	0.52
53	0.45	0.99	0.39
54	0.33	0.93	0.28
55	0.23	0.81	0.18
56	0.15	0.68	0.12
57	0.10	0.53	0.08
58	0.07	0.40	0.05
59	0.05	0.29	0.03
60	0.04	0.20	0.03
61	-	0.14	0.02
62	-	0.09	-
63	-	0.07	-
64	-	0.05	-
65	-	0.04	-
66	-	-	-

Table R 3.37

Column elution of ortho-, meta- and para-nitrotoluenes on column A with 40 % aqueous methanol as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U =	10.65	9.36	5.14
Sample No.		10^2Us =	
v.v.	-	-	-
1-12	-	-	-
13	0.40	-	0.06
14	1.69	0.33	0.27
15	3.51	1.18	0.95
16	3.17	2.50	1.70
17	1.37	2.77	1.40
18	0.38	1.71	0.62
19	0.13	0.66	0.18
20	-	0.21	0.06
21	-	-	-

Table R 3.38

Column elution of ortho-, meta- and para-nitrotoluenes on column A with 10 % methanol in N/100 n-caproic acid as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U =	13.29	15.51	8.65
Sample No.		10^2Us =	
v.v.	-	-	-
1-33	-	-	-
34	0.04	-	0.02
35	0.09	-	0.03
36	0.18	-	0.06
37	0.35	0.04	0.10
38	0.62	0.07	0.19
39	0.98	0.13	0.31
40	1.37	0.23	0.47
41	1.64	0.40	0.71
42	1.83	0.64	1.02
43	1.76	0.95	1.06
44	1.56	1.24	1.09
45	0.79	1.54	1.00
46	0.69	1.71	0.83
47	0.57	1.77	0.62
48	0.35	1.68	0.43
49	0.21	1.45	0.28
50	0.12	1.16	0.17
51	0.06	0.87	0.10
52	0.05	0.59	0.10
53	0.03	0.39	0.04
54	-	0.25	0.02
55	-	0.15	-
56	-	0.09	-
57	-	0.06	-
58	-	0.04	-
59	-	0.03	-
60	-	0.03	-
61	-	-	-

Table R 3.39

Column elution of ortho-, meta- and para-nitrotoluenes on column A with 10 % aqueous ter.butanol as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U =	13.38	9.80	7.00
Sample No.		10^2Us =	
v.v.	-	-	-
1-40	-	-	-
41	0.04	-	-
42	0.07	-	0.05
43	0.17	-	0.12
44	0.35	-	0.22
45	0.61	0.04	0.34
46	0.80	0.07	0.50
47	1.27	0.13	0.66
48	1.56	0.21	0.81
49	1.71	0.33	0.87
50	1.71	0.45	0.87
51	1.53	0.63	0.77
52	1.24	0.79	0.63
53	0.93	0.89	0.47
54	0.64	1.03	0.32
55	0.40	1.03	0.19
56	0.22	0.97	0.11
57	0.10	0.86	0.05
58	0.03	0.72	0.02
59	-	0.56	-
60	-	0.41	-
61	-	0.29	-
62	-	0.19	-
63	-	0.11	-
64	-	0.06	-
65	-	0.03	-
66	-	-	-

Table R 3.40

Column elution of ortho-, meta- and para-nitrotoluenes on column A with resin in NH_4^+ form with 10 % aqueous methanol as solvent and eluant.

Compound :	o-nitro	m-nitro	p-nitro
10^2U =	11.76	12.56	7.36
Sample No.		10^2Us =	
v.v.	-	-	-
1-30	-	-	-
31	0.05	-	-
32	0.09	-	0.02
33	0.17	-	0.04
34	0.29	-	0.06
35	0.48	0.02	0.12
36	0.70	0.05	0.20
37	0.95	0.10	0.31
38	1.17	0.17	0.44
39	1.36	0.28	0.60
40	1.35	0.43	0.70
41	1.26	0.63	0.83
42	1.08	0.82	0.84
43	0.87	1.06	0.79
44	0.65	1.21	0.68
45	0.47	1.31	0.55
46	0.32	1.30	0.41
47	0.20	1.18	0.29
48	0.13	1.03	0.19
49	0.08	0.83	0.12
50	0.05	0.62	0.08
51	0.04	0.47	0.04
52	-	0.34	0.03
53	-	0.29	0.02
54	-	0.15	-
55	-	0.10	-
56	-	0.07	-
57	-	0.04	-
58	-	0.03	-
59	-	0.02	-
60	-	-	-