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Dextrin as excipient in pharmaceutical preparations

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The addition of commercial dextrins to aqueous solvents in thin layer chromatography on cellulose increases the R_f values of azodyes such as methyl orange. The increase is less than with cyclodextrins but shows that dextrins also form supramolecular complexes. This should be considered when dextrins are used as "inert" excipients in pharmacy.

1. Introduction

According to the Merck Index [1] dextrins are used as "excipients for dry extracts and pills, for preparing emulsions and dry bandages". "Excipient" is usually defined as "inert filler, binder or carrier in a medicine" [2]. It is the purpose of this note to report data which show that dextrins do form supramolecular complexes with some simple azodyes. It is thus questionable whether dextrins can be generally considered as being "inert". Their use as excipients should thus not be recommended without examining the specific application in detail.

The effect of cyclodextrins in TLC was examined by Huynh et al. [3] for the separation of enantiomers. It was studied for the separation of flavonoids [4, 5] and in the separation of azodyes [6].

Particularly methyl orange especially forms supramolecular complexes with cyclodextrins [6]. It was then realised that not only cyclo-dextrins but also starches readily form complexes with azo-dyes [7] while no effect could be observed with sucrose nor with linear dextrans. On the other hand the three dextrins marketed by Fluka, Switzerland were shown to complex methyl orange quite effectively [8].

In the present work dextrins obtained from numerous sources were examined and they all seem to complex with methyl orange.

2. Investigations and results

Table 1 shows the R_f values of the azodyes with aqueous 0.1 M NaCl containing various carbohydrates. The most remarkable effects are with methyl orange and ethyl orange. Methyl orange has an R_f value around 0.10–0.15 if no soluble carbohydrate is added to the solvent. With α-cyclodextrin and β-cyclodextrin, this becomes very high (0.93 and 0.72, respectively), with Fluka Dextrin 10 and

Table 1: R_f Values of some azodyes on Merck 5577 microcrystalline cellulose thin layers eluted with 0.1 M NaCl containing various soluble carbohydrates

	0.1 M NaCl eluent +						
	–	5% α-CD	sat β-CD	5% Fluka dextrin D_{10}	5% potato starch	Dextran 6,000	Dextran 200,000
Methyl yellow	0.04	0.72	0	0.12	0.10	0	0
Methyl orange	0.15	0.93	0.72	0.37	0.30	0.10	0.11
Methyl red	0.07	0.14	0.24	0.13	0.30	0.06	0.06
Ethyl orange	0.49	1.0	0.84	0.80	0.63	0.42	0.40
Ethyl red	0.19	0.23	0.58	0.23	0.33	0.10	0.10
Alizarin yellow R	0.06	0.79	0.33	0.25	0.09	0	0
Alizarin yellow 2G	0.06	0.83	0.60	0.16	0.20	0.06	0.07
Sulfanilic acid A.	0.56	0.63	0.76	0.66	0.56	0.55	0.47
Mordant orange 10	0	0.84	0.14	0.08	0.10	0	0
Orange II	0.04	0.10	0.57	0.12	0.13	0.07	0.07
Tropaeolin	0.05	0.93	0.47	0.26	0.26	0.03	0
Indigocarmine	0.10	0.13	0.24	0.15	0.15	0.11	0.12

Table 2: R_f Values of some azodyes on Merck 5577 microcrystalline cellulose thin layers developed with 0.1 M NaCl containing different commercial dextrins

	0.1 M NaCl eluent +						
	–	5% Dextrin PH V	Aldrich Dextrin	Sigma I	Sigma II	Sigma III	Sigma IV
Methyl yellow	0	0.06	0.03	0.06	0	0	0.03
Methyl orange	0.13	0.30	0.26	0.30	0.18	0.24	0.29
Methyl red	0.04	0.08	0.09	0.07	0.08	0.06	0.08
Ethyl orange	0.39	0.89	0.62	0.64	0.51	0.61	0.62
Ethyl red	0.06	0.20	0.16	0.21	0.14	0.19	0.17
Alizarin yellow R	0.06	0.12	0.12	0.10	0.08	0.11	0.10
Alizarin yellow 2G	0.12	0.23	0.18	0.16	0.11	0.19	0.23
Sulphanilic acid azochromotrop	0.67	0.71	0.65	0.64	0.60	0.67	0.70
Tropaeolin	0.05	0.30	0.20	0.22	0.14	0.24	0.26
Orange II	0.06	0.12	0.09	0.10	0.08	0.11	0.10

Table 3: R_f Values of some azodyes on Merck 5577 microcrystalline cellulose thin layers developed with 1 M NaCl containing various concentrations of dextrin 10, 15 and 20

	1M NaCl eluent +							
	–	5% D_{10}	10% D_{10}	5% D_{15}	10% D_{15}	1% D_{20}	5% D_{20}	10% D_{20}
Methyl yellow	0	0.12	0.16	0.12	0.16	0.04	0.08	0.06
Methyl orange	0.03	0.33	0.44	0.29	0.38	0.11	0.22	0.29
Methyl red	0.10	0.09	0.13	0.09	0.11	0.05	0.07	0.10
Ethyl orange	0.43	0.85	≈1.0	0.75	≈1.0	0.44	0.60	0.69
Ethyl red	0.12	0.17	0.22	0.15	0.20	0.11	0.15	0.15

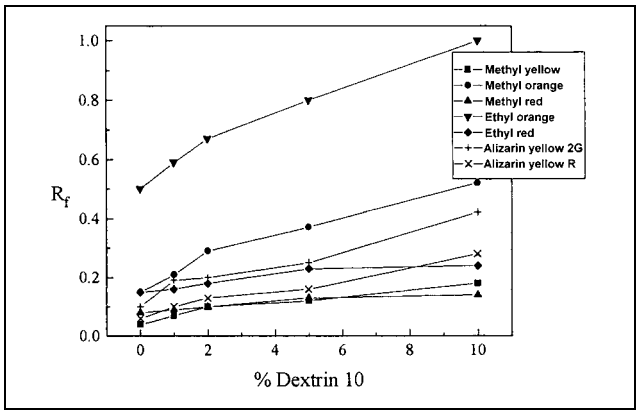

Fig.: R_f values of some azodyes on Merck 5577 microcrystalline cellulose thin layers as a function of dextrin 10 concentration in the 0.1 M NaCl eluent

with potato starch this is 0.3–0.4 and there is no change with Dextrans (e.g. Dextran 6,000 and Dextran 200,000).
In Table 2 are the R_f values with various commercial Dextrins added to 0.1 M NaCl are listed. In all cases methyl orange (from 0.13 to 0.20–0.30) and ethyl orange (from 0.39 to 0.50–0.90) have increased R_f values. Some azodyes do not vary at all such as methyl yellow, methyl red, orange II.
The Fig. shows the change in of R_f value with the concentration of Fluka Dextrin 10 showing that in about 5% solutions the main effect is observed. For the Fluka series the highest effect is observed for Dextrin 10 while Dextrin 15 and Dextrin 20 give a lesser R_f change as shown in Table 3.

3. Discussion

The use of chromatographic methods for the detection of reversible complexing reactions is about as old as chromatography itself. In this case it is a very convenient method as the unit experiment is very simple and fast. Changes of R_f values are rather indicative especially as it in not a general R_f change for a number of compounds but only for some. For example, methyl yellow does not move very differently with dextrins in the eluent while methyl orange does.

The biggest effect that we observed was with methyl orange which increases its R_f value from 0.13 to 0.37 with 5% Fluka Dextrin 10. The same R_f value shift is obtained with less than 0.1% α-cyclodextrin.
The commercial dextrins are a mixture of degradation products of starch with a range of molecular weights. This could mean either that supramolecular complexes are formed by only some constituents or by higher molecular weight compounds or probably both.

4. Experimental

The usual development in small jars (height 100 mm, diameter 65 mm) were used as described previously [6]. Merck Art 5577 DC Plastikfolien Cellulose were cut into pieces 100 mm × 60 mm and the azodyes in ethanol solution placed on a line 15 mm from one end as spots about 2 mm in diameter. The dextrins dissolved in aqueous NaCl (usually 0.1 M) were used as eluents. No reagent is necessary as all the compounds are coloured. The following Dextrins were examined: Fluka (Switzerland) Dextrins 10, 15 and 20 from maize starch; Sigma Chemie (Switzerland) Dextrins Types I, II and III from corn and Type IV from potato; Aldrich (USA) "Dextrin Hygroscopic"; Dextrine Pure PH V from the Pharmacie Internationale (Lausanne)
All produced a clear solution when 1 g of the dextrin was added to 20 ml of 0.1 M NaCl in the cold and shaken for a few minutes.
The dyes examined were Fluka pure chemicals dissolved in ethanol.
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References

1 Merck Index 12th edition, p 2991 (Merck & Co, USA, 1996)
2 Bennett, H.: Concise Chemical and Technical Dictionary, 4th edition, Edward Arnold, London, 1986
3 Huynh, T. K. X.; Lederer, M.; Leipzig-Pagani, E.: J. Chromatog. A, **659**, 191 (1994)
4 Hostettmann, K.; Lederer, M.; Marston, A.; Leipzig-Pagani, E.: Phytochem. Anal., **8**, 173 (1997)
5 Lederer, M.; Leipzig-Pagani, E.: Anal. Chim. Acta **329**, 311 (1996)
6 Huynh, T. K. X.; Lederer, M.; Leipzig-Pagani, E.: J. Chromatog. A, **695**, 155 (1995)
7 Huynh, T. K. X.; Lederer, M.; Leipzig-Pagani, E.: J. Chromatog. A, **695**, 160 (1995)
8 Leipzig-Pagani, E.: Thèse de doctorat, Université de Lausanne 1998

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