THE BEHAVIOUR OF THE PHARMACEUTICAL CLAY ATTAPULGITE TOWARDS VARIOUS ORGANIC MOLECULES

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A B.P. monograph for the adsorbent mineral clay activated attapulgite first appeared in the 1975 Addendum, but the substance had been used previously in proprietary products as a substitute for kaolin, compared to which it has been shown to be a superior adsorbent for some alkaloids and bacterial toxins for example (Barr and Arnista 1957). Atkinson and Azarnoff (1971) reported that prevention of cholinesterase depression after ingestion of a toxic pesticide was longer lasting after attapulgite administration than after activated charcoal, but generally the latter was the better sequestering agent. During work on the effect of drug compounds on the suspension properties of attapulgite, it was noticed that under certain conditions some compounds gave coloured products as well as affecting the sedimentation rate of the clay, and this phenomenon has been investigated further.

Colloidal grade activated attapulgite of average particle size 140nm was washed with distilled water before being dried at 65°C and powdered in a mortar. Some initial adsorption experiments were carried out with salicylic acid, the dried clay being added to aqueous drug solutions to give 2% $^{w}/_{v}$ suspensions. Measurements were made at low (2.7-3.7) and high (12.5) pH, adjustments being made by addition of HCl or NaOH, as Barr (1960) has shown that pH affects viscosity and sedimentation and therefore could also affect adsorption. Concentration measurements showed that no further adsorption of salicylic acid occurred after one hour contact at low pH, but at pH 12.5 free salicylic acid concentrations continued to fall for 48 hours. Preparations in the acidic medium only showed pH changes over the 48 hour period: increases of between 3.9 and 0.7 units were noted depending on salicylic acid concentration. Langmuir isotherms showedcurvature at low concentrations and high pH, but obeyed the theoretical equation at low pH. A purple colouration in the continuous phase was seen in preparations with equilibrium salicylic acid concentrations greater that 6.1 mmol l^{-1}, and a preparation containing 14.2 mmol l^{-1} produced no colouration at any pH above 6.6.

The coloured supernatant showed a spectroscopic absorption peak at 490nm which might be due to the characteristic Fe(III)-salicylic acid complex as attapulgite contains 4% Fe_2O_3 (Barr 1960), the Fe(III) possibly being made available by leaching and ion-exchange with hydrogen ions which could account for the neutralising effect of the clay on acid but not on alkaline solutions. However, change in the clay preparation procedure, and use of regular rather than colloidal grade did not affect colour formation or intensity, nor did the addition of various chloride salts which could interfere in an ion-exchange process. Increase in salicylic acid concentration from 15.0 mmol l^{-1} to 28.0 mmol l^{-1} increased the supernatant absorbance at 490nm from 0.087 to 0.150, but there was no further increase with higher concentrations. Repeat measurements made with 5-sulphosalicylic gave very similar results but preliminary tests with phenol and p-cresol show no colouration although $FeCl_3$ solution will normally give coloured products with these compounds.

Atkinson, J.P. and Azarnoff, D.L. (1971) Clinical Toxicology 4: 31
Barr, M. (1960) Drug and Cosmetic Ind. 86: 340
Barr, M. and Arnista, E.S. (1957) J. Amer. Pharm. Assoc. 46: 486