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A study on the dielectric constant of salicylic acid and aspirin compacts during aging

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Considerable attention has been given to the study of accelerated aging of tablets. The changes in the tablet disintegration time (Lausier et al., 1977), dissolution rate (Chowhand and Palagyi, 1978), and hardness (Bhatia and Shotton, 1979) have all been reported during aging. Compressed tablets have a certain 'structure' which determines its ability to release the drug and disintegrate itself. Alterations in this 'structure' of the tablet during aging is expected to alter its polarisability and hence the dielectric constant (DEC). DEC has been the useful parameter in predicting the changes occurring in microcapsules (Labhasetwar et al., 1988) and emulsions (Reddy and Dorle, 1984) during aging.

In the present study salicylic acid and aspirin acted as the model drugs due to their crystalline nature and easy compressibility. Accurately weighed (500 mg, 53–104 μm in size) dry powder was fed to the die and compressed between two stainless steel pellets using a hydraulic press at a pressure of 2 tons applied for 30 s. These compacts were stored in an oven at 45 ± 1° C and 20% RH. At regular time intervals, compacts were withdrawn and cooled in a desiccator to room temperature (27 ± 1° C). DEC of the compacts was measured with a Q-meter (model E 9-4, N-554, U.S.S.R.) at a frequency of 10 Mc/s. In vitro dissolution study was carried out in distilled water using the standard dissolution rate apparatus USP model XVIII, supplied by Campbell Electronics.

Fig. 1 depicts the changes in the DEC of the compacts during aging. The initial rapid increase

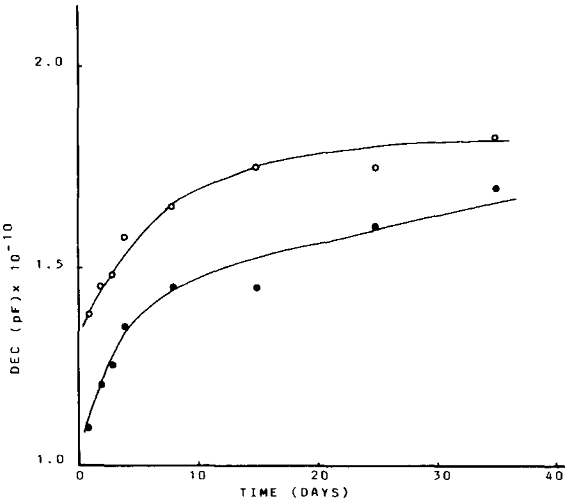

Fig. 1. Dielectric constant of salicylic acid and aspirin compacts during aging. ○, salicylic acid; ●, aspirin. The values are means of DEC of 10 compacts.

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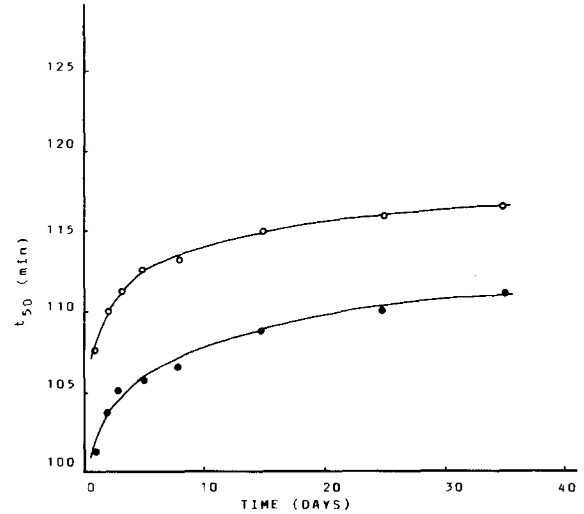

Fig. 2. In vitro dissolution (t_{50}) of salicylic acid and aspirin compacts during aging. ○, salicyclic acid; ●, aspirin. The values are means of 5 determinations.

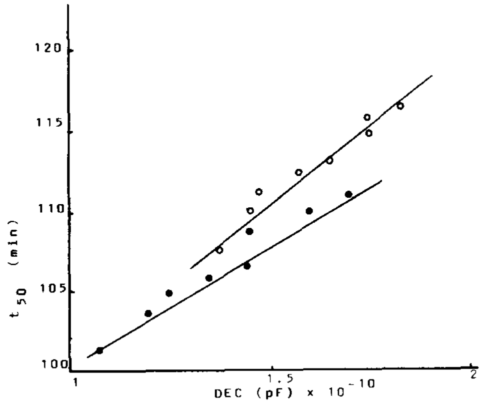

Fig. 3. Correlation between dielectric constant and t_{50}. ○, salicylic acid, $r = 0.997$; ●, aspirin, $r = 0.9674$.

in the DEC was followed by a gradual change. Aging could lead to the interparticulate bonding in the presence of a little moisture associated with the compacts. This enhances the polarisation and in turn the DEC of the compacts. The initial rapid increase in DEC is attributed to more interparticulate bonding during the initial storage period. The t_{50} values of the compacts substantiate this argument very well (Fig. 2). Formation of structure with firm bonds is expected to resist the dissolution in direct relation to the extent of bond formation. A linear relationship was observed between the DEC and t_{50} (Fig. 3). In the case of aspirin, formation of small quantities of salicylic acid during aging cannot be ruled out. However, its contribution towards the total change in the DEC will be negligible. It therefore appears reasonable to believe that DEC could prove a useful parameter in predicting changes occurring in compressed tablets and compacts during aging.

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