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Letter to the Editor

Calculation of the brittle fracture tendency (BFP) of tablets

Dear Sir,

It is always interesting to read papers, which are derived from work with equipment, which is perhaps not of the latest state of the art. Here the authors must use their ingenuity to report novel findings, which are of interest to workers in the field. The paper by Uhumwangho and Okor (2004) falls into this class. The results show that the two materials tested behave in a different manner when compacted, despite the problems of failing to provide any information on the sensitivity of any of the measuring equipment used or any indication of the variability of the values of the measurements made. (We do not wish to go into the problems of the test procedures used, but there are several, which give cause for concern.) We find however, that we really must question the validity of their conclusions as the authors have failed to consider the literature available on the application of the method of determining the brittle fracture tendency (BFP) of their materials. Podczeck and Newton (2001) have clearly shown that, the calculation of the value of the BFP as described by Hiestand et al. (1977) with cubic compacts and applied to circular tablets by Roberts and Rowe (1986), from data using the value of the tensile strength of tablets with and without a central hole, is incorrect because these authors failed to use the correct formula to calculate the tensile strength of the tablets, which had a central hole. The need for this analysis appears not to be appreciated in the pharmaceutical literature. The readers of the *International Journal of Pharmaceutics* since 2001 should have no excuse for this, as the article by Stanley (2001) gives full theoretical explanations for the calculation of the fracture stress form the fracture load for compacted powders tested by a full range of test procedures. He stressed that it is essential to know the stress conditions, which exist in the specimen. These can be obtained by various procedures, including theoretical calculation, photoelasticity measurements and finite element analysis. Unfortunately he did not include the case for the compact with a central hole. In fact the analysis of this configuration had been derived theoretically by Durelli and Lin (1986) and the application of their analysis was introduced into the powder technology literature by Podczeck and Newton (2001). As Uhumwangho and Okor (2004), along with the original authors of the concept of the BFP, point out, the presence of the hole in the tablet will change the stress state at the centre of the tablet but, as with the original authors, they then fail to allow for this change in their calculation of the value of the tensile strength of the tablet containing the hole. Therefore, the values for BFP reported here by Uhumwangho and Okor (2004) are incorrect.

When the correct equations were used, Podczeck and Newton (2001) found that the values of the BFP for microcrystalline cellulose (MCC) and lactose (L), determined from circular tablets with and without a central hole, were very similar and independent of compaction pressure. Such a similarity in value of the BFP for the two materials would not be expected from the many papers published on their mechanical properties. Podczeck and Newton (2001) went on to discuss fully, the reasons why the equation used by Hiestand et al. (1977) was not valid and the concept of the BFP suspect. Interestingly, when Podczeck and Newton (2001) used the standard Hiestand et al. (1977) equation for the calculation of BFP, the values for MCC increased with compaction pressure, which is similar to the response found by Uhumwangho and Okor (2004) for α-cellulose, while the values for L where negative and

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where irregular with pressure changes. (Any of the values for the mechanical properties for lactose obtained by Uhumwangho and Okor (2004) cannot be considered as those for lactose as the material had been granulated with a 20% solution of starch, which will completely change the properties of the material.)

We do not wish to discourage researchers working with limited facilities, as genuine original findings can come from such studies, but it is even more important that such researchers are aware of the literature when presenting their work and no amount of ingenuity can compensate for the use of incorrect equations. There are clearly differences between the mechanical properties of α-cellulose powder and a granulated form of lactose, but in quantifying these differences it is very important to do so correctly as these values become part of the literature.

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