



Effect of baobab pulp powder on controlled release properties of matrix tablet formulated with whey protein and alginate

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Formulas	Powder flow	Tablet compression (Hardness)	Tablet friability	Water uptake	Diameter change	TPH release
				(%, 2 h pH 6.8)		
Free-TPH	E	C	NC	ND	ND	91 ± 11
F2	E	C	NC	97 ± 12	42 ± 15	28 ± 1
F10	G	C	C	66 ± 1	28 ± 1	34 ± 6

For flow measurements and tablet friability, the meaning of the abbreviations E, B, EM, C, NC, and ND is as follows: E: Excellent, G: Good, EP: extremely poor, C: Compliant, NC: Non-compliant, ND: Not determined. For tablet compression and friability: C: compliant, NC: non-compliant

Table 2. Powder flow, tablet friability, swelling and theophylline release after 2h of dissolution in pH 6.8.

A deviation of less than 5% was obtained for all formulations so this deviation is in accordance with the PE. For the 3 formulations, only one have a friability lesser than 1%. This formulation corresponds to a lot of BB. TPH release in dissolution apparatus from free-TPH, F2 and F10 tablet was investigated (Figure 2A).

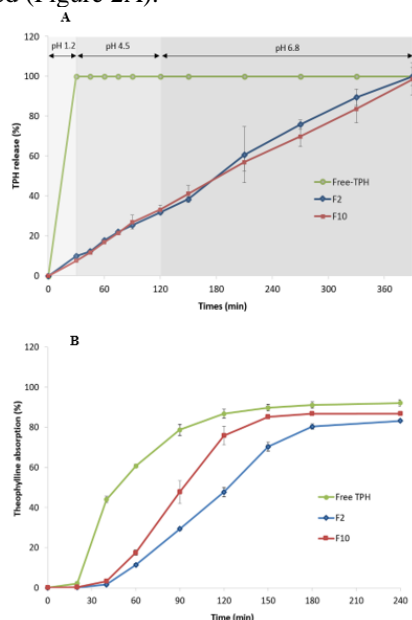


Figure 2: Release kinetics of free-TPH and TPH from Tablet (A) in USP2 (B) and cumulative TPH absorption during digestion in TIM1 (n=3, mean ±SD).

TPH powder dissolution was fast and complete for free-TPH, which is characteristic of a BCS class I drug. On the contrary, TPH release from F2 and F10 tablet was similar with a controlled release in pH 1.2, 4.5 and 6.8 of drug during 390 min. Incorporation of polymers slowed down drug release and modified the behavior of the formulation to achieve a controlled and sustained release. The polymers thus constitute a pH-dependent matrix excipient allowing a prolonged release of TPH. There are different types of active substance release from tablet. The first one, diffusion, appeared during the contact of tablet with the gastro-intestinal juices. The liquid will diffuse inside the tablet and leads to a diffusion of the active substance towards the outside through the matrix. The second type is erosion, the contact between the juices, the enzymes and the peristalsis

will allow the erosion of the tablet and thus the release of the active substance. A mathematical model was used to define the type of release. For F2 and F10, the value of n in the Korsmeyer-Peppas equation is greater than 0.89 indicating a release mechanism predominantly dominated by erosion. The use of the Harland equation confirms these results since the study of the parameters of the equation (A for diffusion and B for erosion) indicates for the formulations a release mechanism of erosion type. The release is due to the water intake and diameter change of the tablets (Table 2) proves the hydration capacity of WP > BB polymers which may be due to the formation of hydrogen bridges between the polymer chains and the water molecules.

Taking into consideration the protein and fiber character of our novel excipient BB, drug release was also evaluated with gastric and intestinal enzymes. Percent represented the amount of TPH released and dialyzed through hollow fibers considered thus as available for *in vivo* absorption (Figure 2B). We can conclude that absorption of free-TPH was fast with T50% absorbed in approx. 45 min and a T80% of 90 min which is characteristic of a BCS class I drug [2]. On the contrary, for F2 and F10 tablets, TPH absorption percentages were significantly slowed down with a prolonged T50% at 120 min and 90 min and a T80% reached in 180 and 135 min of digestion for F2 and F10 respectively. TPH release from F2 and F10 was similar in dissolution apparatus without enzymes but different with enzymes. These results indicated that WP was more resistant to enzymes digestion than BB. Moreover, the profile of release was similar between formulation F2 (18% WP, 8% BB and 2% ALG) and a tablet formulated with 30% WP [2]. A part of WP could be substitute by BB and ALG for the controlled release of TPH.

CONCLUSION

Add BB to the formulation improve WP/ALG tablet process. Polymers influence TPH release in dissolution apparatus in gastric or intestinal pH with a slow and complete release of TPH during 6.5 hours and controlled via swelling and erosion mechanism. Controlled release was confirmed in the artificial digestive. However, proteolytic enzymes accelerated the drug release. BB was more sensitive to enzymes than WP polymer. BB powders can be considered as a new excipient for sustained release applications particularly when absorption is targeted to take place in the jejunum or ileum.

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