

Bovine serum albumin adsorption onto hydroxyapatite and biphasic calcium phosphate ceramic granules

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INTRODUCTION

Hydroxyapatite (HAp), beta tricalcium phosphate (β -TCP) and biphasic calcium phosphate (BCP) are calcium phosphate based ceramics and the most studied biomaterials for bone defect repair [1]. One of the main requirements for these biomaterials is to be bioactive. The bioactivity of calcium phosphate based biomaterials can be evaluated by adsorption of proteins [2]. The most abundant protein in the circulatory system is bovine serum albumin (BSA) therefore this protein is mostly used in vitro studies for bioactivity [3]. BSA sorption results onto HAp and BCP ceramic granules are presented.

EXPERIMENTAL METHODS

HAp and BCP were synthesized by wet precipitation method from calcium hydroxide and phosphoric acid. To identify the ratio of HAp and β -TCP phases X-ray powder diffraction (XRD) was used. The precipitate were filtered and used to form granules. The paste was pressed through 1.4 mm sieve, dried, sieved through 1.4 mm sieve, sintered at 1150°C for 2 h and sieved using vibrational sieves to gain granules with fraction 0.5-1 mm. The obtained fraction was characterized with loose density and specific surface area by BET method. Protein solutions were prepared in simulated body fluid (SBF) and phosphate saline buffer (PBS) solution at pH 7.4 by dissolution of BSA with concentration 2 mg/ml. 0.1 g of granules were mixed with 8 ml of BSA solution and incubated at 37°C with continual agitation for 5 minutes to 24 hours. The residue concentration was determined at 280 nm using UV-VIS spectrophotometer. All calibration solutions also were incubated at 37°C and measured each time together with the samples.

RESULTS AND DISCUSSION

The highest sorption capacity (mg BSA/1 g granules) showed sample with HAp/ β -TCP ratio 50/50 but the lowest sorption showed sample 10/90 in both SBF and PBS media. These results are related to the specific surface area (see Table 1). In SBF media the adsorbed BSA amount is more than 2 times higher than in PBS.

Table 1 Characteristics of the samples studied

COMPOSITION HAp/ β -TCP	LOOSE DENSITY, g/ml	BET, m ² /g
100/0	1.19 ± 0.01	0.92 ± 0.10
80/20	1.06 ± 0.01	0.80 ± 0.07
50/50	0.99 ± 0.01	1.13 ± 0.03
30/70	1.10 ± 0.01	0.80 ± 0.04
10/90	1.23 ± 0.02	0.05 ± 0.01

CONCLUSION

All calcium phosphate ceramic granules showed sorption properties towards BSA in both media. BSA sorption capacity correlates with the specific surface area.

REFERENCES

- [1] Wang K. *et al.*, Interface Focus (2012), 2:259-277
- [2] Combes C. *et al.*, Biomaterials (2002), 23:2817-2823
- [3] Mavropoulos E. *et al.*, Colloids Surface B (201), 83:1-9

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