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Thermal Method Production of the Hydroxyapatite from Bone By-Products from Meat Industry

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Abstract : Introduction: Request for compound of phosphorus grows continuously, thus, it is searched for alternative sources of this element. One of these sources could be by-products from meat industry which contain prominent quantity of phosphorus compounds. Hydroxyapatite, which is natural component of animal and human bones, is leading material applied in bone surgery and also in stomatology. This is material, which is biocompatible, bioactive and osteoinductive. Methodology: Hydroxyapatite preparation: As a raw material was applied deproteinized and defatted bone pulp called bone sludge, which was formed as waste in deproteinization process of bones, in which a protein hydrolysate was the main product. Hydroxyapatite was received in calcining process in chamber kiln with electric heating in air atmosphere in two stages. In the first stage, material was calcining in temperature 600°C within 3 hours. In the next stage unified material was calcining in three different temperatures (750°C, 850°C and 950°C) keeping material in maximum temperature within 3.0 hours. Bone sludge: Bone sludge was formed as waste in deproteinization process of bones, in which a protein hydrolysate was the main product. Pork bones coming from the partition of meat were used as a raw material for the production of the protein hydrolysate. After disintegration, a mixture of bone pulp and water with a small amount of lactic acid was boiled at temperature 130-135°C and under pressure4 bar. After 3-3.5 hours boiled-out bones were separated on a sieve, and the solution of protein-fat hydrolysate got into a decanter, where bone sludge was separated from it. Results of the study: The phase composition was analyzed by roentgenographic method. Hydroxyapatite was the only crystalline phase observed in all the calcining products. XRD investigation was shown that crystallization degree of hydroxyapatite was increased with calcining temperature. Conclusion: The researches were shown that phosphorus content is around 12%, whereas, calcium content amounts to 28% on average. The conducted researches on bone-waste calcining at the temperatures of 750-950°C confirmed that thermal utilization of deproteinized bone-waste was possible. X-ray investigations were confirmed that hydroxyapatite is the main component of calcining products, and also XRD investigation was shown that crystallization degree of hydroxyapatite was increased with calcining temperature. Contents of calcium and phosphorus were distinctly increased with calcining temperature, whereas contents of phosphorus soluble in acids were decreased. It could be connected with higher crystallization degree of material received in higher temperatures and its stable structure. Acknowledgements: “The authors would like to thank the The National Centre for Research and Development (Grant no: LIDER//037/481/L-5/13/NCBR/2014) for providing financial support to this project”.

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