Mendeleev 2024

XIII International Conference on Chemistry for Young Scientists

BOOK OF ABSTRACTS

St Petersburg University

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XIII International Conference on Chemistry for Young Scientists “MENDELEEV 2024”

St Petersburg, Russia
September 2-6,
2024

XIII International Conference on Chemistry for Young Scientists “MENDELEEV 2024”. St Petersburg. September 2–6, 2024. Book of abstracts.— St Petersburg.: VVM Publishing LLC, 2024.— 822 p.

ISBN 978-5-9651-1584-6

Book of abstracts contains theses of plenary, keynote, oral and poster presentations which were presented on **Mendeleev 2024**, the XIII International Conference on Chemistry for Young Scientists. The Mendeleev 2024 Conference hold in Saint Petersburg (September 2–6, 2024).

Abstracts are presented in the author's edition with minimal technical corrections.

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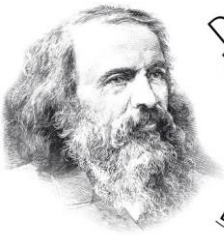

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Аналитика

BIORESORPTION OF MAGNESIUM-BASED CERAMIC

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Currently, the development of bioceramic materials for the treatment of bone tissue defect capable of resorbing in a biological environment is a pressing issue. This is because ceramic materials based on calcium phosphates such as hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) and tricalcium phosphate ($Ca_3(PO_4)_2$) have a low dissolution rate [1, 2]. Magnesium phosphates could be considered as potential candidates for the development of such materials. Therefore, the aim of this study was to create bioceramic materials based on $Mg_3(PO_4)_2$ and $Mg_4Na(PO_4)_3$, and to investigate the process of ceramic resorption in a simulated environment of citric acid solution.

Mixtures based on $Mg_3(PO_4)_2$ and $Mg_4Na(PO_4)_3$ were prepared to obtain ceramic materials. For the synthesis of magnesium orthophosphate ($Mg_3(PO_4)_2$), a solid-phase method was used. The precursors used were magnesium oxide (MgO) and magnesium pyrophosphate ($Mg_2P_2O_7$), taken in a stoichiometric ratio. Double magnesium-sodium phosphates ($MgNaPO_4$) were obtained by solid-phase synthesis according to a previously developed method [3-5]. Double magnesium-sodium phosphate, $MgNaPO_4$, was obtained by two-stage heat-treatment of a mixture of magnesium pyrophosphate and sodium carbonate, Na_2CO_3, at 900 °C and 600 °C with exposure for 10 hours. $Mg_4Na(PO_4)_3$ was obtained by a solid-phase method from mixtures of $MgNaPO_4$ and $Mg_3(PO_4)_2$. Ceramics based on these mixtures ($Mg_3(PO_4)$ and $Mg_4Na(PO_4)_3$) were produced by pressing tablets with a diameter of 8 mm. The mixtures were calculated based on the reaction:

$$(1\text{-}3x)Mg_3(PO_4)_2 + 2xMg_4Na(PO_4)_3 \rightarrow Mg_{(3\text{-}x)}Na_{2x}(PO_4)_2, \text{ where } x = 0\text{-}0.25$$

The resorption kinetics of magnesium-sodium phosphates ceramic granules was studied on the titrator with citric acid. In this work, pH=5 value was set to accelerate the resorption process.

The solubility of magnesium-sodium double phosphates in a model medium (citric acid) was evaluated, and it was shown that ceramic granules based on $Mg_3(PO_4)_2$ and $Mg_4Na(PO_4)_3$ are resorbed while maintaining pH = 5 for 1 day. The developed ceramic material is promising for bone replacement in regenerative medicine.

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Acknowledgements
This work was supported by the Russian Science Foundation (project No 22-19-00219).