# The comparison of hydroxyapatite/ iron oxide compsite properties and its constituents

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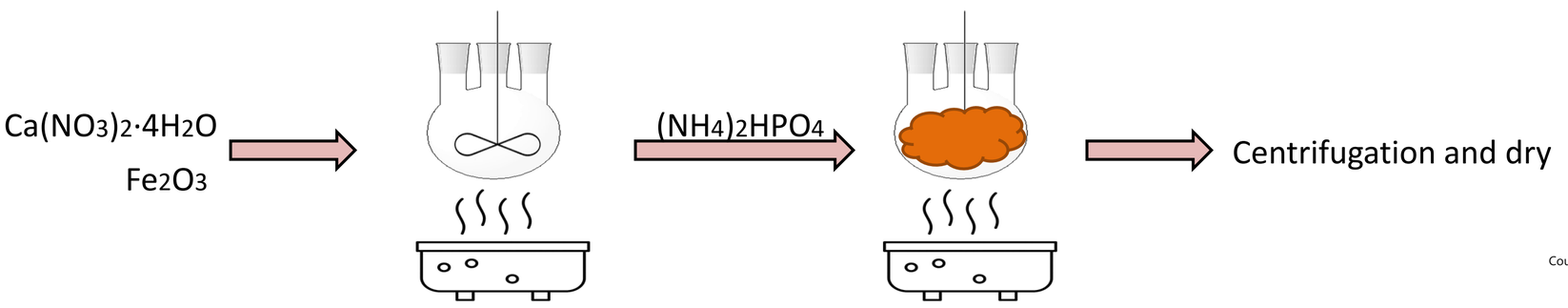
## Introduction

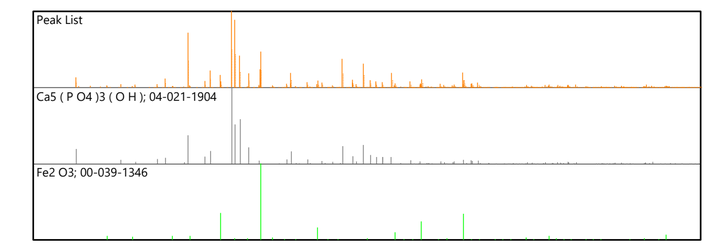
Hydroxyapatite is one of the components of synthesized composite. It is the outer layer. It is a mineral composed mainly of calcium and phosphorus atoms, with a ratio of 1.67. Hydroxyapatite has excellent sorption properties due to the presence of voids in its structure. The structure can also be modified by isomorphic substitutions in both the cationic and anionic networks. Its popularity is also due to other properties it displays, like biocompatibility and thermal stability. This makes it a widely used material, e.g. in medicine, or also in adsorption processes.

The second component of mentioned composite is iron oxide. Three forms can be distinguished here in particular, namely magnetite, maghemite and hematite. These oxides are widely distributed in nature and have many applications. Their most important property is ferromagnetism. The first of them – magnetite - is a mixed oxide composed of iron II and III ions. It is an opaque crystal with a metallic or semi-metallic sheen. The other two oxides have iron III ions in their structure, but maghemite is thermally unstable and can transform into hematite at high temperatures.

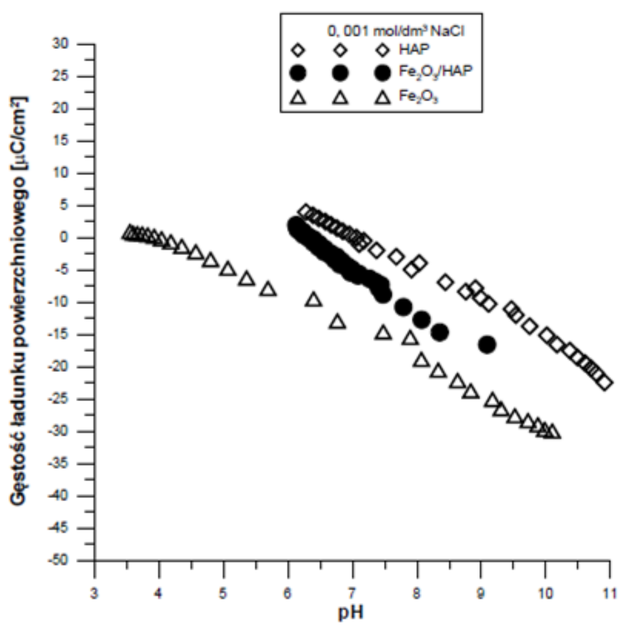
## Methods

Pure hydroxyapatite powder was obtained by the co-precipitation method. At first, calcium nitrate solution was placed in a three-neck round bottom flask and heated in a water bath for 30 min with constant stirring. After that, the diammonium hydrogen phosphate solution, which had previously been adjusted to a pH of 10 with ammonia water, was added dropwise over 2 hours. The obtained precipitate was washed and centrifuged with redistilled water until a constant conductivity value was obtained. At the end, the powder was dried in an oven at 100 ° C for 24 hours. The composite synthesis procedure was very similar, but additionally at first stage an appropriate amount of iron (III) oxide was added in the flask with the calcium nitrate solution. The subsequent synthesis steps were the same as in the previous example. The obtained sediment was orange-brown in color. All samples were analyzed and the results are shown below.

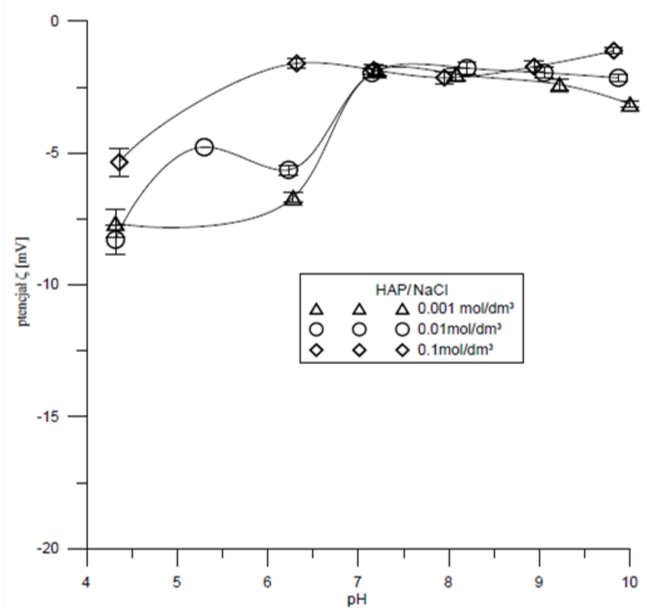


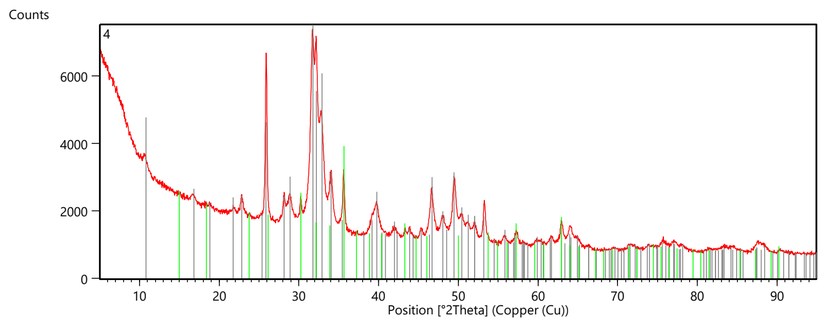

## Results



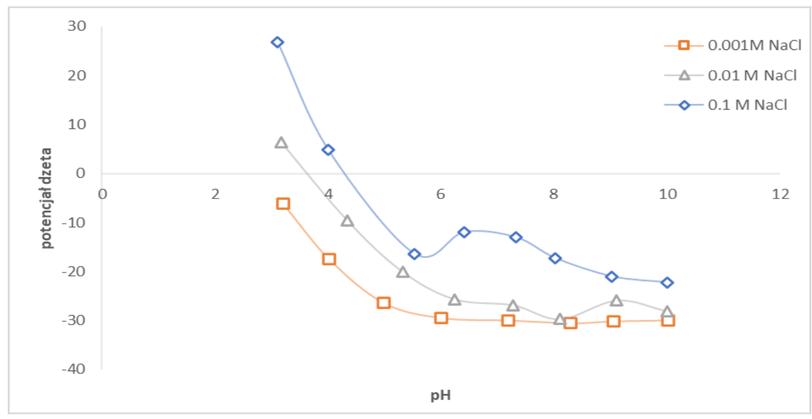

Graph 1. Dependence of surface charge density on pH for the Fe2O3 / HAP / NaCl system; Fe2O3 / NaCl and Hap / NaCl




Graph 2. Relationship between zeta potential and pH for Hap sample




Surface analysis utilizing XRD method



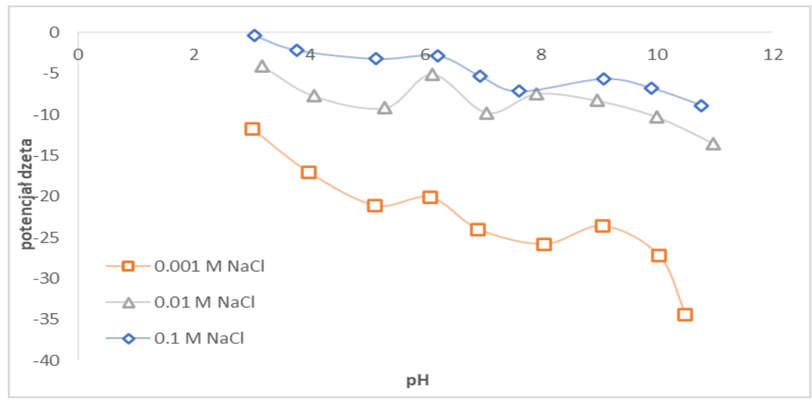

Graph 3. Relationship between zeta potential and pH for iron oxide(III) sample

## Conclusions

•The X-ray pattern of the obtained iron trioxide nanoparticles indicates the creation of γ-Fe2O3 which is proved by the following peaks: 35.55 - 100% and 62.6 - 40%.

•The point of the curves intersection corresponds to the pH at which there is point of zero charge for hydroxyapatite and it is equal to 7 and approx. 6 for the composite. The pHpzc for Fe2O3, determined in a different way due to the lower solubility of the compound, is 4.There is a clear difference in this value between the components of the composite and the composite itself. The shift of this value towards hydroxyapatite results from the dominant role of phosphate and calcium groups on the composite surface.

• The zeta potential decreases with an increase in electrolyte concentration. It can be also seen that the zeta potential decreases with increasing pH. The composite samples showed stability only at the highest ranges of pH.




Graph 4. Relationship between zeta potential and pH for composite sample

**References**

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