UTILIZATION OF AGRICULTURAL AND FOOD WASTE TO OBTAIN BIOFUNCTIONALIZED MAGNETITE PARTICLES

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1. INTRODUCTION

- The production and processing of plant-based foods generates a large amount of biowaste, which can have a negative impact on the environment if not disposed of properly. On the other hand, this waste is rich in valuable substances that can be isolated using suitable technologies and later used in an intelligent process. One possible use is is for obtaining biofunctionalized magnetite particles.
- When magnetite is synthesized by co-precipitation in the presence of plant extracts, various compounds are incorporated into the surface of the particles, which influences their functionality and properties. Biofunctionalized magnetite particles have the potential for effective use in catalytic processes and in water treatment.

This study investigates the synthesis of biofunctionalized magnetite particles in the presence of onion peel extract (*Allium cepa*) and the analysis of their properties.

2. MATERIALS AND METHODS

❖ **Preparation of the plant extract**: The extraction of the onion peels was carried out with water in a subcritical state (at 140°C under autogenous pressure), for 10 minutes.

Characterization of extracts
- ❖ TPC
- ❖ TFC
- ❖ DPPH
- ❖ EC_{50}

Magnetite particles were sinthetysed from Fe salts by coprecipitation at 80°C.

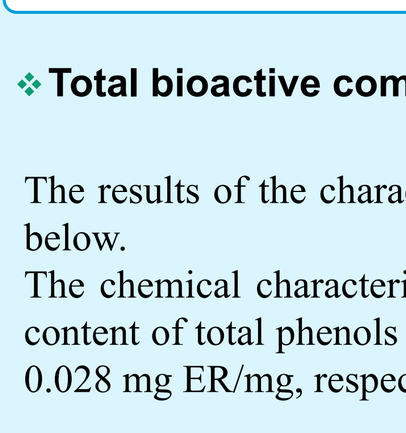
Characterization of biofunctionalized MNPs:
- ❖ XRD
- ❖ FTIR

3. RESULTS AND DISCUSSION

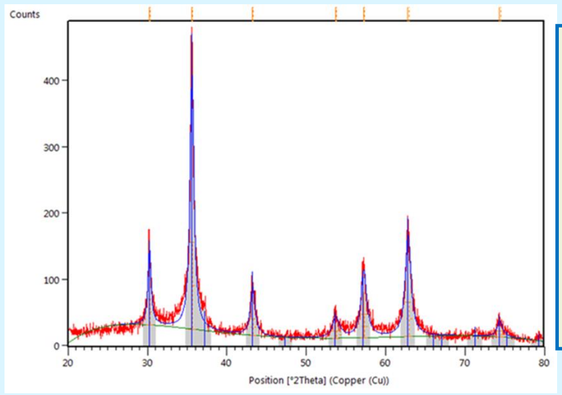
❖ Total bioactive compounds and antioxidant capacity

The results of the characterization of the extracts are shown in table below.
The chemical characterization of the obtained extract revealed high content of total phenols and total flavonoids (0.119 mg GAE/mg and 0.028 mg ER/mg, respectively), as well as high antioxidant activity.

In particular, the extract showed a high ability to neutralize DPPH free radicals (IC_{50} was 10.0 mg/g) and a high reducing power (EC_{50} was 10.6 mg/g).



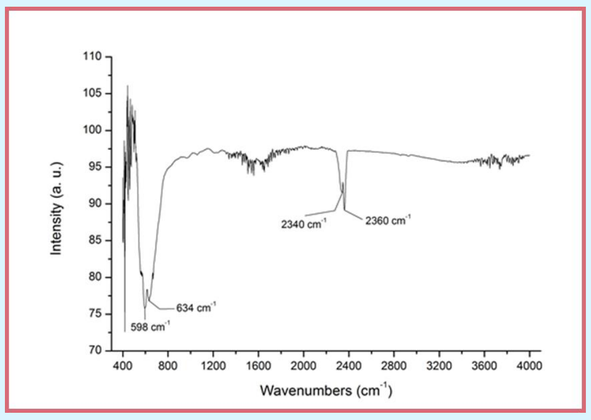
	Onion peel extract
TPC (mg CAE/mg)	0.119
TFC (mgER/mg)	0.028
DPPH (mg/g)	10.040
EC50 (mg/g)	10.584



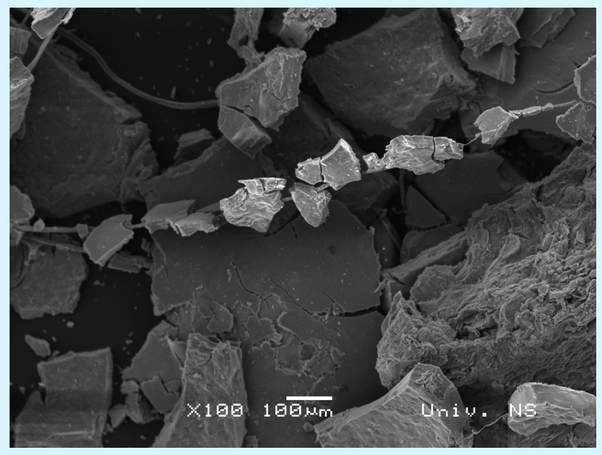
XRD analysis

XRD analysis confirmed that magnetite was obtained from Fe sulphate salts by the co-precipitation process (Ref. Code 96-900-5841).

The average crystallite size for bio-MNPs is 14 nm.



FTIR spectra of bio-MNPs



SEM analysis

4. CONCLUSIONS

- ❖ It has been confirmed that the co-precipitation method from Fe salts in the presence of plant extracts leads to the formation of biomagnetite.
- ❖ Biomagnetite can be used in various environmental processes.

Acknowledgement: This research was supported by the Science Fund of the Republic of Serbia, #GRANT No 7464, Novel Bio-linked Magnetite/geopolymer Composites in Phenol-containing Wastewater Treatment: Toward Zero-waste Technology - BioCompWaterClean.

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