CATALITYC DEGRADATION OF ORGANIC DYES USING METALLIC NANOPARTICLES

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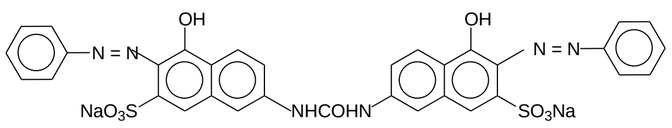
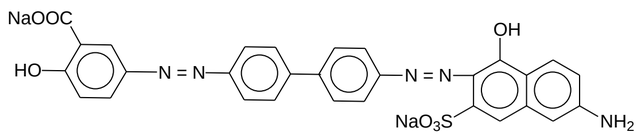
INTRODUCTION

Nowadays, there is a growing need for methods that contribute to the environmental protection and help increase the human well – being and, therefore, different pollutants are studied: pharmaceuticals, hormones, polycyclic aromatic hydrocarbons and dyes. Among them, a special attention needs to be paid to dyes and especially organic dyes due to the fact that their accumulation in water bodies s responsible for reducing the reoxygenation ability killing the marine organisms by blocking the sunlight. Photocatalytic degradation using metallic nanoparticles has numerous advantages to the conventional route of quick oxidation because neither polycyclic compounds nor the oxidation of different pollutants appears.

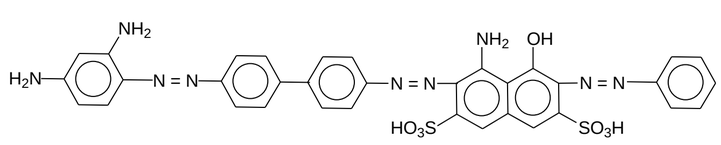
This research paper describes the use of silver nanoparticles (AgNPs) for the catalytic degradation of three azoic dyes: **Direct Orange 26 (DO26)**, **Direct Black 38 (DBk38)** and **Direct Brown 2 (DBr2)**. Silver nanoparticles were prepared using a "green chemistry" approach from aqueous extracts of different plants with important health benefits: Gooseberry, Acacia and Jujube.



Direct Orange 26 (CI 29150)



Direct Brown 2 (CI 22311)



Direct Black 38 (CI 30235)

MATERIALS AND METHODS

For the green synthesis of AgNPs, the three plants (Gooseberry, Acacia and Jujube) were used to prepare the corresponding aqueous extracts, at room temperature, no stirring, for 24 h and then, further, AgNPs were synthesized at room temperature and at 50^0C.

The formation of the AgNPs was investigated using UV-Vis, FTIR, DLS spectra and their antioxidant activity was determined using the DPPH assay.

The catalytic activity of the green synthesized AgNPs was determined based on the **reductive degradation of dyes in the presence of a reductive agent**.

3 mL dye solution (50 mg/L) was mixed with 0.2 mL reductive agent and 0.2 mL AgNPs

The catalytic performance was monitored by recording the **UV – Vis absorption** at a **specific wavelength** for each dye:

Table 1: UV -Vis absorption for the azo - dyes

Dye	UV – Vis absorption (nm)
Direct Orange 26 (DO 26)	495
Direct Brown 2 (DBr 2)	470
Direct Black 38 (DBk 38)	520

RESULTS AND CONCLUSIONS

The qualitative screening for bioactive compounds of the three aqueous extracts revealed the presence of saponins, carbohydrates, alkaloids, etc., highlighting their excellent capacity to green synthesize AgNPs.

The UV-Vis spectra were recorded at different time intervals and exhibited peaks at 437 nm (Gooseberry), 440 nm (Acacia) and 450 nm (Jujube).

FTIR measurements showed the presence of major functional groups in the structure of the AgNPs (e.g.: C=C, C=O, C-H, etc.).

The catalytic reductive degradation of the three textile dyes showed that:

- the highest decrease of the maximum absorption intensity and, therefore, the highest degradation of DO 26 and DBk 38 is observed in the case of Gooseberry – AgNPs (Table 2);

Table 2: Catalytic degradation of DO26 using Gooseberry - AgNPs

Sample	Reaction time				
	0 min	15 min	30 min	1 h	ΔA
DO 26 (sol 50 mg/L)	1.786	-	-	-	-
DO+AgNPs-Gooseberry	1.496	1.456	1.440	1.411	22.34
DO+AgNPs-Acacia	1.500	1.458	1.392	1.347	28.33
DO+AgNPs-Jujube	1.697	1.674	1.670	1.658	8.79
DO+AgNPs- Gooseberry +reductive agent (RA)	1.151	1.212	1.170	1.125	43.35
DO+AgNPs- Acacia +RA	1.187	1.188	1.124	1.072	46.02
DO+AgNPs- Jujube +RA	1.297	1.291	1.208	1.146	45.02

- in case of DBr 2, the decrease of the maximum absorption intensity is higher than 50%, whatever the raw vegetal material used for the green synthesis of AgNPs;
- in the studied reductive degradation, the highest values for ΔA were found for DBr2.

Acknowledgements: This paper was prepared with the financial support of the project PN 19.23.03.01.04.