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Removal of a Yellow-Orange Cosmetic Dye by a Biosorbent Derived from the Outer Shell of the Argan Fruit

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ABSTRACT

In this study, the powder of the external pulp of the fruit of the argan tree was used as an adsorbent material to adsorb an orange-yellow dye (cosmetic) present in wastewater, from an aqueous solution. An adsorption test was carried out and the rate of adsorption of the yellow-orange dye by the adsorbent material gave an adsorption rate of over 90%. The adsorption is consistent with excellent adsorption parameters. The material showed excellent performance at acidic pH and no performance at basic pH, with an optimum time of no more than 10 minutes. The SEM gave excellent images confirming the porosity of the adsorbent material. The biosorbent synthesised in this work has potential for the adsorption of dyes in wastewater.

Keywords: argan pulp, yellow orange dye, biosorbent, adsorption

1 Introduction

Groundwater and surface water have been exploited due to several harmful impurities and among all chemical impurities, chemical dyes are one of the most harmful impurities which have serious side effects on human and marine life. Synthetic dyes and pigments are widely used as colorants in various industrial processes, including the pharmaceutical, textile, leather, paper, petrol, food and other industries, and a huge amount of unused synthetic dyes is discharged into waterways every year by various industries around the world. Because dyes are coloured by nature, they are visible even in very low concentrations, and their resistant nature also reduces the penetration of sunlight into the water. Consequently, their release into the environment is a major source of contamination [1]. The argan tree is only endemic to southern Morocco. The vast area covered by argan trees, known as the Argan Forest, was designated a UNESCO Biosphere Reserve in 1998 [3]. Eleven years later, argan oil was certified internationally as a Protected Geographical Indication (PGI) product. These two international awards are not only prestigious, they also guarantee the quality and stability of the biotope in which the argan trees grow [2]. The global drive to reduce greenhouse gas emissions and the development of new energy sources will increase demand for raw materials and, consequently, for mining and recycling. emissions and the development of new energy sources will increase demand for raw materials and, consequently, mining operations and recycling. Mining waste resources are an option for diversifying the supply of certain critical minerals. In addition, the use of this waste avoids the environmental problems associated with its deposition and alteration in the environment [3].

2 Experimental

The aim of this work is to recover waste from the argan tree collected in the town of Mostaganem to produce an adsorbent material for use in wastewater treatment and the elimination of the yellow-orange dye by applying the adsorption process. The preparation of our adsorbent material from the waste of the argan tree, in particular the outer shell of the fruit of the argan tree as noise material without any treatment.



The adsorbent material powder obtained was evaluated for the elimination of the yellow-orange dye in aqueous solution and the various optimisation parameters were studied and characterised by : scanning electron microscopy (SEM), infrared spectroscopy (IR) and X-ray diffraction (XRD) and various chemical characterisations such as iodine index moisture content ash content and pH_{pzc} zeta potential index and methylene blue index to characterise the surface functions of texture and adsorption capacity.

3 Results and Discussion

The material obtained showed that the outer shell powder is an excellent adsorbent with an adsorption rate of over 90% and the physical-chemical results of our material show a low moisture and ash content and a porous structure developed with a high iodine value. Excellent SEM images confirm the porosity of the adsorbent material with excellent optimal adsorption parameters

4 Conclusions

Our study and the results obtained show that fine powder from the outer shell of the fruit of the argan tree has excellent potential to be a good, inexpensive and highly effective adsorbent material for wastewater treatment, giving rise to a biomaterial with excellent adsorption results that make it an alternative to commercial carriers.

References

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