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A NOVEL APPROACH FOR EXTRACTING RED PIGMENT FROM GANODERMA SPECIES BRACKET FUNGUS USING AQUEOUS SODIUM BICARBONATE.

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ABSTRACT

Due to the toxic & non-biodegradable synthetic dyes the textile & food industries are increasing demand of environmentally friendly natural dyes has awareness of underutilized biological resources such as the use of Ganoderma species. The use of aqueous sodium bicarbonate (NaHCO3) solution in our body pays off is not significant. In this method involved soaking the mushroom powder in 0.5 M NaHCO3 for 48 hours, then heated at 80°C for 2 hours. The UV Spectrum analysis confirm the alkaline treatment produced a deep red-brown response with maximum absorbance at 490 nm. The extraction yield was approximately 3.2% (w/w), which is aggressive by conventional natural solvent methods. Our findings show that sodium bicarbonate, a safe and cheaper reagent, effectively breaks down the tough chitinous mobile wall of Ganoderma, facilitating pigment release.

1. INTRODUCTION

Synthetic dyes widely used in the textile and food industries are notorious for their environmental toxicity and non-biodegradability thus there is a global resurgence in the search for herbal dyes from plant and microbial sources[1,2]. Among them, fungi, especially bracket fungi (multipores), are a little-explored reservoir of potent and vibrant paint[3].

Ganoderma species, well known in their medicinal world, additionally produce many secondary metabolites, such as purple-yellow pigment[4]. These pigments, basically polypeptide and phenoxazinone derivatives, five their ability antioxidant properties. Typically, pigment extraction from fungi uses natural solvents such as ethanol, methanol, or acetone [5,6]. However, these solvents are volatile, flammable, and pose a risk to conditioning.

Sodium bicarbonate ($NaHCO_3$) has been previously investigated for the extraction of water-soluble polysaccharides and melanin from Ganoderma[7,8], but its use for the extraction of pink pigment Using an extended wet heating system is no longer officially known. Also, the optimization of extraction parameters through solvent-solvent extraction has been further investigated penetration, cell wall hydrolysis.

In this study we seek to fill that gap by comparing the efficacy of an aqueous $NaHCO_3$ extraction method primarily tailored to Ganoderma purple-red pigment.

2. METHODOLOGY

2.1 Collection and Preparation of Fungal Material

Ganoderma species was collected from the Sahyadri rain forest. The samples were thoroughly washed to remove debris, thinly sliced and dried in a hot air oven at 60 °C for 24 hours. Until a constant weight was perfected Dried samples have been ground into a powder.

2.2 Preparation of Extraction Solvent

A 0.5 M sodium bicarbonate ($NaHCO_3$) solution was prepared by dissolving 42gm of AR grade $NaHCO_3$ in 1 liter of distilled water. The pH of the solution was adjusted to 8.3 using a pH meter.

2.3 Extraction

A 100 g of dried mushroom powder is combined with 2 L 5 M Sodium Bicarbonate ($NaHCO_3$) beaker and allow to soak undisturbed for 48 hours at room temperature (25 ± 2°C). The long soaking time facilitated the penetration of the alkaline latter into the dense chitinous mycelium matrix, thus improving pigment removal after hydration, the mixture was heated at 80 ± 2°C for 2 hours in a water bath to enhance the pink pigment emission. What was then filtered into the beaker converted to a cumulative from which the crude reddish pink pigment extract was used for subsequent analysis.

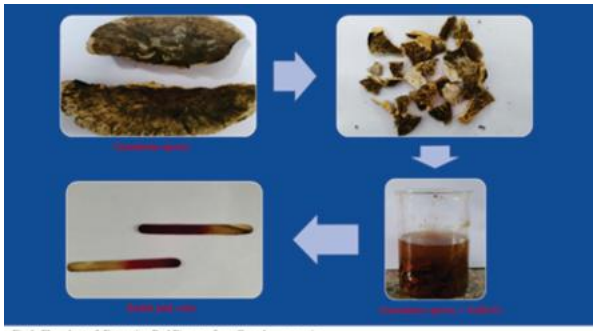

Fig 1: Flowchart of Extracting Red Pigment from Ganoderma species

3. RESULTS AND DISCUSSION

3.1 Pigment Yield and Physical Observation

To determine the percentage yield, 50 mL of the filtrate was dried. The dry weight of the residue was measured, and the yield was calculated as a percentage of the original dry fungal weight. The extraction method produced a deep red response. The calculated pigment yield was three.2% (w/w) of dried fungal biomass. This is significantly better than the 2.1% reported for ethanol-based total extraction in similar gonorrhea species[9]. This indicates that the combination of alkaline hydrolysis and prolonged soaking significantly improves the solubility of the pigment.

3.2 UV - Spectral Analysis

The crude extract was scanned using a UV-Vis spectrophotometer (Shimadzu UV-1800) in the wavelength range of 300–700 nm to identify the characteristic absorption peak of the purple-red pigment. The UV-Vis spectrum of the extract showed a major absorption peak at 490 nm, which falls within the visible range for red pigments. This result aligns with the spectral characteristics of phenoxazinone-type pigments previously isolated from basidiomycetes[10]. A minor shoulder was observed at 350 nm, possibly indicating the presence of co-extracted polyphenolic compounds.

3.3 Mechanism of Extraction

The 24-hour soaking period allows complete hydration of fungal cell wall compounds, especially chitin and β-glucan. Extended hydration has been shown to destabilize inelastic fungal cell wall architecture, increasing its susceptibility to chemical degradation[11]. Sodium bicarbonate ($NaHCO_3$) acts as a moderate alkalinizing agent to assist within the extraction

system by inhibiting soap ester binding in the fungal wall sodium salt with acidic beneficial chains (e.g., –COOH), which complements their hydrophobicity and promotes transition to aqueous phase followed by heat curing at 80°C for 2 hours as well as improving the extraction efficiency by denaturing proteins and enzymes that can degrade pigments, which in all cases will reduce extraction rate and increase the diffusion rate[12,13]. Although temperatures higher than 90°C are known to destabilize unstable purple pigments, maintaining the temperature at 80°C for 2 hours helps maintain chromophore stability in an alkaline environment[14,15,16].

3.4 Comparative Evaluation

When compared to the traditional ethanol extraction method, our $NaHCO_3$ protocol offers distinct advantages:

1. Non-Toxicity: It eliminates the fire hazards and toxicity associated with organic solvents.
2. Cost-Effectiveness: $NaHCO_3$ is significantly cheaper than high-grade ethanol.
3. Color Stability: Preliminary stability tests indicate that the alkaline extract retains its color depth for up to 14 days, presumably due to the stabilizing effect of the basic pH[15].

4. CONCLUSION

This process effectively allows Ganoderma species using aqueous sodium bicarbonate. The combination of 48 hours of irrigation and a couple of hours of temperature turned out to be green, producing a wavelength of 490 nm. Given that this particular combination of parameters and reagents is not currently found in the mainstream medical literature, we believe that this method represents a novel contribution to the field of natural dye extraction.

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