Development of Fabric Dye Using Bacterial Pigments

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ABSTRACT

The wastes from industries which produce textile dyes using toxic chemicals and processes pose serious threats to the environment that are often very difficult to treat and dispose. Certainly, there is a need of environment conservation, and more research should be done in order to save it. Therefore, the prime focus of this study is producing microbial dyes as advanced alternative to make dyes from pigments naturally produced by non-pathogenic bacteria which contain carotenoids and astaxanthin.

Keywords: JAR6 strain, actinomyces, dye, extraction, non-pathogenic, toxicity, mutagenicity, carcinogenicity, biodegradable.

INTRODUCTION

The usage of textile dyes has been carried out since centuries and they were firstly obtained from natural sources due to which they were considered harmless for the environment but as the time passed, techniques changed. New chemicals were produced for the synthesis of dyes, making these dyes harmful for the environment. These non-biodegradable dyes are discharged in the water, containing lots of toxicity, mutagenicity and carcinogenicity which are the untreated effluents that affect the purity of water. Here, the production of environmentally friendly non- pathogenic fabric dyes that can be obtained from pigments naturally present in bacteria is discussed. The production of dye is cost effective as it requires less amount of temperature, water, and surface area. In addition, it is harmless to the environment and workers. This dye can stain number of materials like cotton, silk, wool, nylon, etc. and will remain stable even after wash. It will be ensured to provide bright colors to the fabric, due to the strong pigmentation and provide clinical efficiencies.

OBJECTIVES

Our fundamental goal is to provide an ecofriendly microbial fabric dye primarily based on colored pigments produced evidently with the aid of using non-pathogenic micro-organisms, not only imparting color to the fabric but also having significant clinical properties, such as acting as a powerful antioxidant and preventing instances of cancer among workers as well. Synthetic dyes are one of the major effluents causing pollution. Non-biodegradable heavy metals, present in textile industry effluent, once released in the aquatic environment, can accumulate in the tissues and organs of aquatic animals. Later on, which are eaten by other animals and eventually humans, resulting in disturbance of the entire food web. Moreover, people working in textile industries contract life-threatening diseases. Due to alarming rate of diseases, toxicity, mutagenicity and carcinogenicity, medical professionals advise switching to microbial fabric dye produced by bacteria, from textile dyes because it is relatively beneficial to organisms present in the ecosystem. From spilling of hazardous chemicals into waterbodies to the releasing of toxic gases like carbon monoxide, carbon dioxide, nitrogen and Sulphur oxides pollutes the environment entirely. This project focuses on the use of local resources which are not a threat to our environment and its living systems. Its manufacturing further focuses on the introduction of new technologies and development of work force by increasing employment opportunities.

METHODOLOGY

The process comprises of simple methods for sample collection which consist of bacteria as our main isolate that is obtained through settle plate techniques. There are several examples of isolates, but we aim to work with actinomyces genus. The first step of the procedure involves the collection of this gram-positive genus of bacteria, which can be isolated from soil or leaf litter samples and then further inoculated into chemically defined media and incubated in dark places for 2-3 weeks for dye extraction. Here, identification of strains through gram staining and biochemical characterization methods will take place. Methods like scanning electron microscopy will be carried out to investigate the detailed structure of the microbe, biochemical analysis and phylogenetic characterization will be utilized to observe temperature tolerance and other capabilities of JAR6 strain to work according to the requirements. The morphological analysis will be observed by the cover slip method. Resistance towards antibiotics of the JAR6 strain will be examined by using disk diffusion method. Eventually, solid liquid phase extraction will be used to extract pigment with cyclohexane. After the purification and absorption of the dried pigment, it will be collected, concentrated, and observed on chromatographic plates. To make sure that the dye is safe for human use, it is finally tested through patch test and standard disk diffusion technique described by Kirby & Bauer for potential occurrence of hypersensitivity and microbial pathogenic activity.

RESULT/CONCLUSION

The JAR6 strain is expected to show pigmented and abundant growth on carbon sources such as starch, inositol, lactose, dextrose, mannitol, maltose, and fructose. The strain might be sensitive to some antibiotics but resistant to tigecycline, ampicillin, oxacillin, methicillin, penicillin, chloramphenicol, fluconazole, and clindamycin. The strain is predicted to depict the spore chain morphology. The pigment production is prognosed to be the highest at 7.0 pH on 9th day with starch and soybean meal as carbon and nitrogen sources of the JAR6 strain. The pigment extracted from *actinomyces* except *s. Aureus, p. Aeruginosa* and *k. Pneumonia,* are likely to show antimicrobial and antioxidant activity, and it can also be efficiently used in therapeutic applications.

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