BIOSORPTION OF CATIONIC DYES, METHYLENE BLUE AND RHODAMINE B BY GRAM-NEGATIVE BACILLI DURING GROWTH

Dinorín Téllez Girón, J., Delgado-Macuil R.J., Rojas-López, M., López-y-López, V.E.*
(1) Centro de Investigación en Biotecnología Aplicada del IPN. Ex-Hacienda San Juan Molino K.M. 1.5, Carretera Estatal Santa Inés Tecuexcomac-Tepetitla, Tepetitla de Lardizábal, Tlaxcala, 90700, México.

E-mail: *jabeldtg77@yahoo.com.mx, delgadom@ipn.mx, mrojasl@ipn.mx, vlopezyl@ipn.mx*

ABSTRACT

Cationic dyes Methylene Blue (MB) and Rhodamine B (RB) were used to evaluate the Biosorption capacity of isolated Gram-negative bacilli during growth. The bacteria had an absorption capacity on MB, but not on RB. MB sorption not coincided with exponential growth, it started approximately at 12 hours of culture and reached a removal capacity of 53% at 24 h; to remain constant the next 26 hours and increased to 73 % at 60 h. Cellular counts in MB culture presented 25, 20 and 22% fewer at 12, 24 and 30 h, respectively compared to that of the control culture. RB had no effect on bacterial growth; however at 3 h was observed a 23% increment on concentration; thereafter such concentration diminished to original values along the experiment.

Keywords: biosorption, Methylene blue, Rhodamine B

INTRODUCTION

Dyes are widely used in various industries such as textiles, paper, plastics, cosmetics, leather and food. Disposal of untreated effluent onto water bodies such as rivers or lakes inhibits aquatic life necessary for self purification by reducing penetration of sunlight, with a consequent reduction in photosynthetic activity. Dyes can react with metal ions to form substances which are very toxic to fish and another aquatic life (Karthikeyan 1989). Dye biodegradation by microorganisms is difficult because dyes are designed to resist microbial attack (Mahony et al. 2002). The majority of technologies for color removal are based on physicochemical processes, such as dilution, sorption, oxidation, ion-exchange, reverse osmosis and ultrafiltration (Banat et al. 1996). Some of these methods are effective in dye removal, however their cost are generally high. Adsorption process involves phase transfer of dye molecules onto adsorbent leaving behind the clear effluent (Patel and Suresh 2008). Activated carbon is the most widely used adsorbent. However its cost has prevented its application, at least in developing countries. Therefore, it is necessary to search for alternative low-cost adsorbents which can be used as a substitute of activated carbon (Maurya et al. 2006).

Research groups have explored the possibility to utilize a wide range of economical adsorbents such as raw agricultural solids, industrial solids wastes, natural materials and biomass (Patel and Suresh 2008). Biosorption that could be defined as the sequestering of organic and inorganic substances including metals, dyes and odor compounds using live or death biomass or derivatives. This biomass may be bacteria, fungi, algae, sludge of wastewater treatments plants, byproducts of fermentation industries or seaweeds and the removal mechanism is mainly sorption. The biosorption capacity of biomass depends of several factors. It includes the type of biomass (species age), type of sorbates, presence of others contaminants and method of biomass preparation (live or death), along with several physicochemical factors (temperature, pH, ionic strength). Most of studies on biosorbents are referred to fungal biomass. However, bacteria are more available by-product or waste material from many biotechnological processes. Besides bacteria's have major superficial area than fungi species an important factor for an adsorbent material. Hence, it is necessary to evaluate the potential of different bacteria's as adsorbent materials.

The aim of present study was to find the biosorption capacity of isolated Gram-negatively bacilli during growth on the cationic dyes Methylene Blue and Rhodamine B.

MATERIALS AND METHODS

Adsorbent (bacteria)

A Gram-negative bacilli was isolated from Puebla soils in previous studies, it was grown in petri dishes with nutrient agar at 30°C during 24 h. On single colony was used to inoculate 1-l Erlenmeyer flask