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ORIGINAL ARTICLE

Bioadsorption of Dyes using Vegetable and Fruit Peels

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ABSTRACT
Colors are vibrant and add delight, it is hazardous in many aspects too. When it is made with synthetic compounds and it mixes with fresh water in natural sources, it is considered polluted and hazardous. Vegetable and fruit peel like coir pith, fruit and vegetable peel are used as an adsorbent to remove several commercial dyes from effluents. In the present study 6 different fruit and vegetable peels were used for the study which proved that the lesser the concentration of dye the better was the adsorption. Four different concentrations (100 mg/L, 200 mg/L, 300 mg/L and 400 mg/L) of Methylene green, methylene blue, methylene orange, crystal violet and crystal red was used in the study. It was observed that the percent of degradation of different dyes was different ; however, the maximum adsorption was seen at least concentration of the dyes. Hence, use of chemicals to bleach or purify the effluent can be replaced by biological farm wastes.
Keywords: *adsorption, effluent, dye degradation, methylene green, crystal violet, crystal red.*

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INTRODUCTION

In today's world water pollution is a sustaining issue which is worked upon worldwide. The ways to reduce or nullify the effect is a key concept [1]. Various sources are responsible for the let out of these pollutants, however, one such industry is the textile industry [2]. Nowadays water Pollution is one of the most dangerous threats to environmental in today's modern world [3]. The classes of dyes are based on their composition and application as vat, mordant, chemical, natural, vegetable, azo and basic dyes [4]. Color in the effluent is one of the most obvious indicators of water pollution and the discharge of highly colored synthetic dye effluents is aesthetically displeasing and can damage the receiving water body by impeding penetration of light [5]. The presence of synthetic dyes in wastewater can cause an increase of BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) levels. Moreover, the chromophoric groups strongly absorb sunlight and therefore, photosynthetic activity of organisms is inhibited [6]. Instead of using chemical to purify the effluent biological remnants can be used for degradation of the effluents. In this pursuit, the peel of *Citrullus lanatus (*Watermelon), *Citrus limetta* (Sweet lime),*Raphanus sativa* (Radish), *Carica papaya* (Papaya), *Zea mays* (Corn) and *Momordica charantia* (Bitter gourd) was used for the study.

MATERIALS AND METHODS:

Preparation of dyes: Five different concentrations of dyes (100mg/L, 200 mg/L, 300 mg/L, 400 mg/L and 500 mg/L) namely, methylene blue, methylene green, methylene orange, crystal violet and crystal red were used for the study.

Preparation of the samples: The skin peels of the above mentioned fruits and vegetables were dried in shade and made into a dry powder. To every 25 mL of dye 12.5 mg of dry powder of samples was added and stirred and left in orbital shaker for 3 hours.

Adsorption study was conducted by measuring the OD values of different concentration of dyes in the presence of different adsorbent like, *Citrus limetta, Carica papaya, Zea mays, Citrulluslanatus, Momordica charantis* and *Raphanus sativa.*

Adsorption study was conducted in boiling tubes, 25ml dye taken and 12.5mg of vegetable and fruit peel powder was added into the dye sample. The tubes were kept at room temperature and the OD values were taken after filtration. Each of the dye has a different wavelength at which the optical density can be

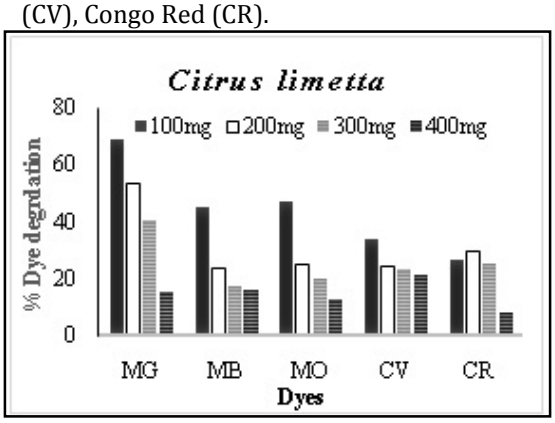
read Congo Red is read at 470, Malachite Green- 650, Methylene Blue- 650, Methyl Orange- 490 and Crystal Violet -590.

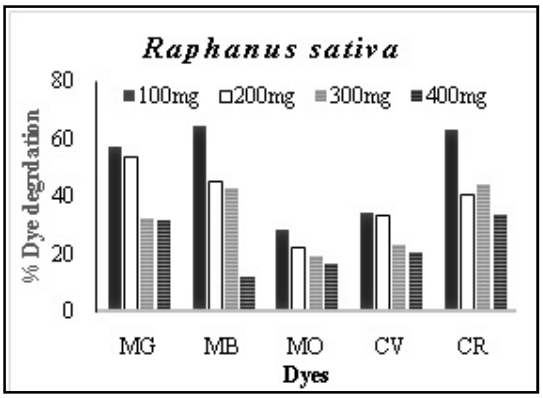
$$\text{Degradation (\%)} = \frac{\text{Initial adsorbance value} - \text{Observed adsorbance value}}{\text{Initial adsorbance value}} \times 100$$

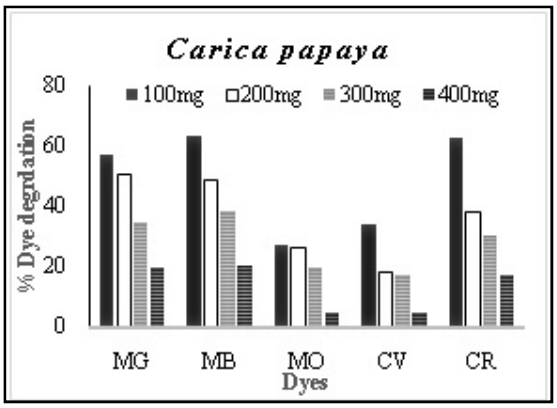
RESULTS AND DISCUSSION

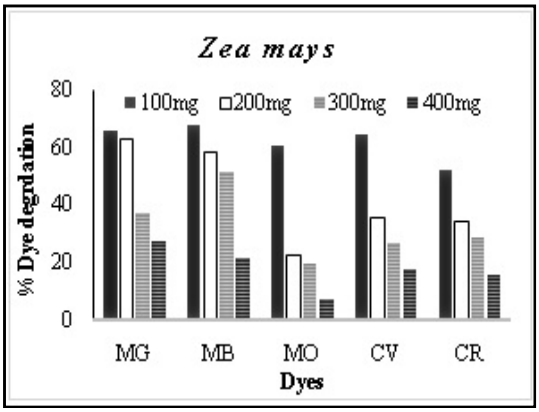
All the six samples of fruits and vegetable peels showed different amounts of dye degradation. Each type of dye showed a different response, however, methylene blue and methylene green showed best results compared to the rest of the dyes. Also, the concentration of the different dyes played a vital role in degradation. The greater the concentration of the dye, the lesser is the adsorption which means it is inversely proportional. In 100mg concentration *Zea mays* show 70%degradation, *Citrus limetta* shows maximum degradation occur up to 50%, in 400mg concentration *Zea mays* shows maximum degradation up to 35%. Compared to 100mg concentration, the 400mg degradation rate was decreased in all 6 samples. It is evident that if dye concentration increases degradation will be decreased [7]. Similar trend was proved in *Cucumis sativus* peel which was used as an adsorbent [8]. In this study, percentage of adsorption capacity of *Cucumis sativus* decreased with the increases of dye concentration. Similar result observed with algae where was used to remove congo red dye in different dye concentration (10ppm-40ppm), maximum percentage of removal showed in 100ppm and minimum in 40ppm dye solution [9]. It was also reported that sugarcane bagasse was used to remove dye, 50mg/L -250mg/L dye concentration used in that 50mg shows maximum degradation and 250mg shows lesser level of degradation [10]. Only methyl orange at higher concentration shows very less dye adsorption in all the six samples. It can be attributed to the fact that more time when made available for the dye to make attraction complex with orange peel helps in the adsorption process [11].

Legent for Graph: Malachite Green (MG), Methylene Blue (MB), Methyle Orange (MO), Crystal Violet (CV), Congo Red (CR).









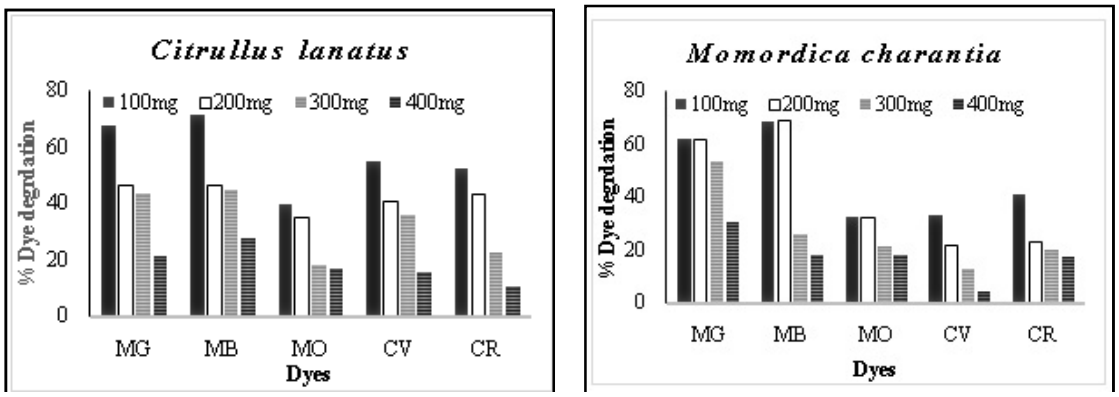


Figure 1 : Percent of dye degradation due to different concentrations of dyes

CONCLUSION

Adsorption of effluent dyes with the use of biological farm waste or skin/peels of fruits and vegetables is an excellent source for decolorization of the dyes from textile industries. However, it is dependent on the concentration of the dyes used.

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