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# Adsorption of Methylene Blue Using Tea Waste Treated with Alkaline-Potassium Hydroxide

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**Abstract.**Textile dyes which are known to be poisonous, mutagenic, and carcinogenic to human health and the environment are found in water bodies, posing a severe environmental threat. The well-known adsorption approach, which uses low-cost agricultural waste as an adsorbent, has recently been extensively explored for water remediation. The ability of tea waste (*Camellia Sinensis*) species treated with alkaline-potassium hydroxide (KOH) to adsorb methylene blue (MB) dye from dye-contaminated wastewater was investigated. The influence of experimental parameters including pH, initial dye concentration and contact time, temperature and adsorbent dosages on the alkaline-KOH treated tea waste adsorption process were studied. SEM and FTIR were used to characterize the KOH treated tea waste adsorbent. The pH 10 condition was shown to be the best for attaining the highest percent of methylene blue removal. The optimal adsorption for methylene blue was greatly detected at 120 minutes of 100 mg/L. The removal of methylene blue was excellent at a temperature of 60 $^{o}$C and 0.1 g of KOH treated tea waste dose was chosen as the most favourable for the adsorption of methylene blue. Finally, the synthetic wastewater was examined under optimal conditions and recorded 97 % methylene blue removed.

## Introduction

Since the 1970s, Malaysia has been one of the world's largest textile and apparel manufacturing countries. According to the (MIDA) Malaysian Investment Development Authority 's Chief Executive Officer, the textile and apparel sector has been a continuous contribution to the national economy in terms of investments and export profits. Per the Malaysian Investment Development Authority (MIDA), the investments are worth RM1.2 billion and create 2,838 jobs in 2020. This is over double the amount of new employment generated (1,421) and 2.7 times the RM441 millions spent in 2019. The Federation of Malaysian Fashion, Textile and Apparel (FMFTA) claimed the Malaysian fashion, textile and apparel industry's export value was RM21 billion in 2020.

Apart from its economic importance, pollution is a consequence, with wastewater being an environmental concern [1]. The majority of untreated hazardous wastewaters from textile manufacturers, such as dyes, are discharged straight into water bodies [2]. Discharge of dye wastes into water bodies is one of the most hazardous industrial practices, polluting both the water and the environment. Even at extremely low concentrations, the release of dyes containing effluents into the water bodies impact the visual quality of the water [3]. Textile dye wastewater has been shown in studies to reduce dissolved oxygen levels and inhibit aquatic organisms' reproduction when it enters a water body [4,**5**]. Dye synthesis contributes to occupational diseases like multifactorial chronic kidney disease and leads to a rise in noncommunicable illnesses, like hormone disturbances, allergies and asthma, and severe respiratory disorders [6].