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Removal of Co(II) from waste water using dry cow dung powder : a green ambrosia to soil

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Abstract:
Co(II) is one of the hazardous products found in the waste streams. The anthropogenic activities are major sources of Co(II) in our environment. Some of the well-established processes such as chemical precipitation, membrane process, liquid extraction and ion exchange have been applied as a tool for the removal of this metal ion [1]. All the above methods are not considered to be greener due to some of their shortcomings such as incomplete metal ion removal, high requirement of energy and reagents, generation of toxic sludge or other waste materials which in turn require further treatments for their cautious disposal.

The present investigation entails the application of dry cow dung powder (DCP) as an indigenous, inexpensive and eco-friendly material for the removal of Co(II) from aqueous medium. DCP, is naturally available bio-organic, complex, polymorphic humified fecal matter of cow and is enriched with minerals, carbohydrates, fats, proteins, bile pigments, aliphatic–aromatic species such as 'Humic acid' (HA), Fulvic acid, Ulmic acid [2,3]. Batch biosorption experiments were conducted employing 60Co(II) as a tracer and effect of various process parameters such as pH (1-8), temperature (283-363K), amount of biosorbent (5-40 g/L), time of equilibration (0-30 min), agitation speed (0-4000 rpm), concentration of initial metal ions (0.5-20 mg/mL) and interfering effect of different organic as well as inorganic salts were studied. The Kinetic studies were carried out employing various models but the best fitting was given by Lagergren Pseudo-second order model [4] with high correlation coefficient R2 value of 0.999 and adsorption capacity of 2.31 mg/g. The thermodynamic parameters for biosorption were also evaluated which indicated spontaneous and exothermic process with high affinity of DCP for Co(II).

Many naturally available materials are used for biosorption of hazardous metal pollutants, where most of them are physically or chemically modified. In this research work, DCP has been utilized without pre or post chemical treatment. Thus it manifests the principal of green chemistry and proves to be an eco-friendly biosorbent.

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