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CO_2 emission equivalent as the climate change measure for the electronic waste: The laptop life cycle assessment for Newfoundland and Labrador, Canada

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The aim of the study is to provide a better knowledge of the electronic waste (e-waste) sector. This sector is explored in terms of structure, stakeholders, governance aspects and social impacts. We also try to examine what is the right thing to do with e-waste. The work examines the following specific questions: 1) What is the state-of-the-art of e-waste recycling in Canada and Newfoundland? 2) Who are the important stakeholders and what are their roles in this sector? 3) What are the governance issues enabling this sector operation? 4) What is the environmentally sound way to deal with e-waste? The study consists of a cover essay and two chapters. The objective of Part I is to provide an investigation of electronic waste recycling system in Newfoundland and Labrador (Canada), Part II provides with a complete Life Cycle Assessment (LCA) of a laptop, with an emphasis on various treatment scenarios: Landfilling, recycling as e-waste, and recycling as metal, by CO_2 equivalent. Part I presents the national and local e-waste flows, the sector structure, the actors involved and the existing governance issues of the e-waste management. Part II assesses CO_2 emissions associated with every stage of laptop life cycle: Production – distribution – use – disposal; and compares laptop end-of-life scenarios by CO_2 equivalent, thus trying to identify the waste management method of least environmental impact and most profit.

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Production and characterization of exopolysaccharide bioflocculants produced by Acromobacter spp.: Biosorption of heavy metals

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Present study highlights isolation of bio-flocculent producing microbes; Achromobacter sp. TERI-IASST N and Achromobacter xylosoxidans TERI L1, capable of biosorption of multi metals (Pb, Zn, Cd, Ni, and Cu). These microbes were isolated from heavy metal contaminated activated sludge samples collected from petroleum refineries. At optimum process parameters (pH 7.5, 37°C temperature, 1% sucrose as feed stock, 120 h incubation period) bioflocculating activity of 'TERI L1' strain enhanced (in presence of sucrose as carbon source) to 83.3%. This activity decreased to 73%, when grown in presence of multi-metals. 'TERI L1' could adsorb 90% of multi-metals when grown in presence of 1250 mg L^{-1}Zn, 2 mg L^{-1}Cd, 30 mg L^{-1} Pb, 200 mg L^{-1}Ni and 90 mg L^{-1}Cu and could adsorb 1100 mg L^{-1} of Pb, when grown in presence of 1500 ppm lead nitrate. 'TERI-IASST N' demonstrated 90% flocculation activity (in absence of heavy metals) at optimum condition; 'pH 6, temperature 37 °C, C/N ratio 1, 1% sucrose as feed stock, 120 h incubation period). In presence of multimetals, flocculation activity of strain N decreased to 84%. 'TERI-IASST N' strain revealed 430 mg L^{-1} Zn and 30 mg L^{-1} Pb. Bioflocculant yield efficiency of 'TERI-IASST N' and 'TERI L1' strains were; 10.5 g/L and 5 g/L, respectively. The bioflocculants were thermostable and retained up to 80% flocculating activity after being heated at 90°C for 30 minutes, which is attributed to the polysaccharide backbone. LC–MS analysis confirmed the bioflocculants as, carbohydrate hetero-polymers. Nuclear magnetic resonance studies revealed that the bioflocculants were glycoproteins. To the best of our knowledge this is the first study that reports the isolation of A. xylosoxidans strain that has significant potential for bioflocculant production as well as for adsorption of multi-metals. The exopolysaccharide bioflocculants produced by 'TERI L1' and 'TERI-IASST N' strains have good potential for bioremediation of heavy metal contaminated wastewater.

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