

BIOFILM BIOFERTILIZER MITIGATES HEALTH RISKS ASSOCIATED WITH POTENTIALLY TOXIC TRACE ELEMENT ACCUMULATION IN RICE GRAINS

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In Sri Lanka, the annual per capita consumption of rice fluctuates around 100 kg. However, rice is often contaminated with potentially toxic trace elements (PTTE), which may lead to many health complications in the long run. The use of chemical inputs [e.g. chemical fertilizers (CF)] has been the main reason. As microbes reduce the bioavailability and mobility of these PTTE, implementing microbial interventions in rice cultivation is a need of the hour. In the present study, the Department of Agriculture (DOA) recommended fertilizer practice (100% CF), 66% CF + Biofilm biofertilizer (66% CF + BFBF), and 66% CF alone were used as treatments. In each treatment, the heavy metal content in rice grains was compared using ICP-OES. According to the results, concentrations of PTTE showed in the order of Zn > Cu > Ni > Cr > As in all three treatments. The least amount of Cadmium (Cd) and Co were in 66% CF + BFBF and 100% CF practices, respectively. The BFBF application decreased the heavy metal concentrations in rice grains compared to the 100% CF application. This could be attributed to the immobilization of PTTE by soil microbes through enzymatic microbial detoxification, production of sulfides and carbonates enhancing the precipitation of toxic metal ions, cellular sequestration, and bio-adsorption. Furthermore, the results indicated that the BFBF practice with reduced CF could lower Cd to impose the lowest estimated daily intake. The hazard quotient (HQ) of As was 1.8 in the 100% CF (DOA practice), indicating potential health risks, while in the BFBF practice with reduced CF, it was reduced down to 0.4. In addition, the hazard index was decreased from 3.7 to 1.6, indicating a lesser likelihood of adverse health effects with 66% CF + BFBF practice. Therefore, it can be concluded that the addition of BFBF with a reduced CF can provide a healthier plate of rice than the use of 100% CF.

Keywords: BFBF, Hazard index, Hazard quotient, Potentially toxic trace elements, Rice grains