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Micro-Nutrient Bio-Fortification in Sprouts Grown on Fortified Fiber Mats

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Abstract : This research study was designed to determine if food crops could be bio-fortified with micro-nutrients by growing sprouts on mineral fortified fiber mats. Diets high in processed foods have been found to lack essential micro-nutrients for optimum human development and overall health. Some micro-nutrients such as copper (Cu) have been found to enhance the inflammatory response through its oxidative functions, thereby having a role in cardiovascular disease (CVD), metabolic syndrome (MetS), diabetes and related complications. Recycled cellulose fibers and clay saturated with micro-nutrient ions can be converted to a novel mineral-metal hybrid material in which the fiber mat becomes a carrier of essential micro-nutrients. The reduction of ionic to metallic copper was accomplished using hydrogen at temperatures ranging from 400o to 600oC. Copper particles with diameters ranging from ~1 to 400-500 nm reside on the recycled fibers that make up the mats. Seeds purchased from a commercial, organic supplier were germinated on the specially engineered cellulose fiber mats that incorporated w10 wt% clay fillers saturated with either copper particles or ionic copper. After the appearance of the first leaves, the sprouts were dehydrated and analyzed for Cu content. Nutrient analysis showed 1.5 to 1.6 increase in Cu of the sprouts grown on the fiber mats with copper particles, and 2.3 to 2.5 increase on mats with ionic copper as compared to the control samples. The antibacterial properties of materials saturated with copper ions at room temperature and at temperatures up to 400°C have been verified with halo method tests against Escherichia Coli in previous studies. E. coli is a known pathogenic risk in sprout production. Copper exhibits excellent antibacterial properties when tested on S. aureus, a pathogenic gram-positive bacterium. This has also been confirmed for the fiber-copper hybrid material in this study. This study illustrates the potential for the use of engineered mats as a viable way to increase the micro-nutrient composition of locally-grown food crops and the need for additional research to determine the uptake, nutritional implications and risks of micro-nutrient bio-fortification.

Keywords : bio-fortification, copper nutrient analysis, micro-nutrient uptake, sprouts and mineral-fortified mats
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