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ANTIMICROBIAL AND DETOXIFYING EFFECTS OF AN EDIBLE BIOPOLYMER POLY (γ-GLUTAMIC ACID)

Bing-Huei Chen
Fu Jen Catholic University, Taiwan

Owing to an increase in antibiotic-resistant microorganisms and side effects associated with conventional detoxification chelation therapy, the potential of an edible and biodegradable biopolymer poly(-glutamic acid) (PGA) was explored as an alternative antimicrobial and detoxifying agent. The PGA-based magnetic nanoparticles (PGA-MNPs) were synthesized by co-precipitation of ferric chloride and ferrous sulfate using ammonium hydroxide, followed by without coating (bare MNPs) and 8% coating with sodium salt of PGA (NaPGA) or 11.8% with calcium salt of γ-PGA (CaPGA). Evaluation of both NaPGA- and CaPGA-MNPs for their antimicrobial activity by agar dilution assay showed a lower minimum inhibitory concentration in *Salmonella* Enteritidis SE 01 than the commercial antibiotics linezolid and cefaclor, but the former was effective against *Escherichia coli* ATCC 8739 and *Staphylococcus aureus* ATCC 10832, whereas the latter was effective against *Escherichia coli* O157: H7 TWC 01. As a detoxifying agent, PGA showed a rapid adsorption of lead and cadmium at pH 5-8 with a Langmuir adsorption capacity (LAC) of 98.70 and 31.13 mg/g in deionized water and 147.71 and 23.15 mg/g in simulated gastrointestinal fluid respectively. Interestingly, the LAC remained unaffected in the presence of several essential metals such as Cu, Fe, Zn, Mg, Ca and K. Lead and cadmium removal by only PGA also showed similar results with a LAC of 213.58 and 41.85 mg/g at pH 5.5 respectively. In *in vivo* study, the lead-induced intoxication of mice treated with PGA was evaluated by comparing with a standard drug meso-2, 3-dimercaptosuccinic acid. Administration of 200 and 400 mg/kg of PGA reduced the accumulation of lead in liver, heart and testis with the latter dose being effective in decreasing the lead content in kidney and spleen. Also, the PGA at both doses reduced TBARs in kidney and brain, elevated δ-aminolevulinic acid dehydrase activity in blood and decreased the activities of both pyruvic transaminase and lactic dehydrogenase in serum.