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NANOENCAPSULATION OF LACTIC ACID BACTERIA USING NANOFIBERS FROM AGROWASTES

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Lactic acid bacteria (LAB) such as *Lactobacillus acidophilus* are well-associated with probiotic properties. Immobilization and encapsulation protect cells from harsh environments. In this study, nanofiber encapsulants are produced from fibrous agricultural wastes (agrowastes) such as oil palm and soybean. This eases processing and increases the availability of orally administered LAB. Alkali treatment was used to extract soluble fiber supernatant (FS) from okara (O), oil palm trunk (OPT) and oil palm frond (OPF). The FS produced was converted into functional nanofibers, using electrospinning technology. Addition of polyvinyl alcohol (PVA) into FS enhanced the morphology of electrospun fibers, and scanning electron microscopy showed smooth continuous fibers 200 to 500 nm in diameter with scattered bundles/beads encapsulating bacteria. The fiber size and viability of nanoencapsulated bacteria was influenced by factors such as viscosity, conductivity and pH of spinning solutions. Fluorescence microscopy revealed fluorescent viable cells within nanofibers, forming bundle-like structures. Viability assay showed good stability of the bacteria despite exposure to high shear stress and voltage, retaining the initial counts in electrospun nanofibers. Bacteria encapsulated in nanofibers produced from OPF showed the highest ($P < 0.05$) storage stability, with survival percent of 80.99 ± 1.05 % 21 days of storage at 4°C. Bacteria encapsulated in nanofibers produced from OPT and okara had survival percentages of 59.07 ± 0.71 % and 49.74 ± 2.98 %, respectively. PVA in nanofibers served as a good protective barrier to exclude oxygen from nanofibers, while all adsorbed moisture have been removed during electrospinning process. The exclusion of oxygen and moisture extended the shelf-life of the LAB while encapsulation could further protect cells from the harsh gastrointestinal environment prior to intestinal release.
keywords: Nanofiber, Lactobacillus acidophilus , Agrowaste, Oil palm, Okara, electrospinning