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Chitomask: An Innovative Intervention for Mitigation of Inhalation and OccupationalToxicology

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ABSTRACT

BACKGROUND

Chitosan is obtained from the deacetylation of chitin. Chitin is one of the most abundantly available polymers after cellulose. Chitosan is a copolymer of glucosamine and N-acetylglucosamine and it has an amine functional group which is strongly reactive with metal ions. Considerable research has been done on the uptake of metal cations by chitosan, (Rhazi, 2002).Chitin is an abundant organic material found mostly in crustaceans, mollusks and insects where it forms a constituent of the exoskeleton, (Guibal, 2004). It is also represented in fungal cell walls. Chitosan is therefore a copolymer of glucosamine and N-acetyl glucosamine, (Rojas, 2005). It is composed of β-(1 4)-2- amino-2-deoxy-D-glucopyranose (glucosamine units) and β-(1 4)-2-acetamido-2-deoxy-Dglucopyranose (acetylglucosamine units),(Hamdine, 2005). The term "chitosan" refers to chitin that has been deacetylated to greater than 60%. Chitosan has many properties that have generated interest in its use such as biodegradability, biocompatibility and its nontoxic nature, (Varma, 2004).

Nose masks are often used to serve am barriers to prevent or reduce inhalation of airborne particles in environments suspected to be laden with toxic substances. Most airborne toxicants are still able to pass through conventional face or nose masks into the human nostrils, posing a variety of toxic effects.

OBJECTIVES: This study was intended toinnovatively produce a nose mask impregnated with modified chitosan to impact ion trapping/ binding capacity to a conventional nose mask, taking advantage of its chemical properties, polar end and adsorption, absorption and ionic properties and subsequent activation by aerosolized water molecule.

This is intended to enable the resulting nose mask- Chitomask, reduce the inhalation of toxic metal ions and other forms of airborne toxicants, thereby serving as a mitigative strategy for inhalation toxicology in industrial and occupational settings in Nigeria.

METHODS

Extraction

Chitosan was extracted from chitin-rich snail shells by the processes of deproteinization, demineralization and deacetylation.

Deproteinization (powdered shell was boiled with 4% weight/volume (w/v)NaOH for 2hours)

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Demineralization

The sample was demineralized using 1% HCl with four times its quantity. The samples were allowed to soak for 24 hours to remove the minerals (mainly calcium carbonate) as previously described by Trung*et al.,* (2006).

Deacetylation was carried out by adding 50% NaOH and then boiling at 100°C for 2 hours in a water bath as described by Muzzarelli and Rochetti, (1985).

Extraction of Chitosan from a chitin-rich source (snail shells)

The extracted Chitosan was further subjected to treatment to achieve a dry whitish powder chitosan.

A conventional safety nose mask was structurally modified to possess adhesive meshes onto which the chitosan powder was systematically impregnated.

RESULTS: Chitomask (chitosan-impregnated safety nose mask), intended to work as an innovative intervention for mitigation of inhalation and occupational toxicology in industrial and occupational settings in Nigeria.

Chitosan powder produced

Chitomask (Safety nose mask): An Innovative Intervention for Mitigation of Inhalation and Occupational Toxicology

CONCLUSION: Chitomask, a chitosan-impregnated safety nose mask, is intended to impact the ion binding property of chitosan unto conventional nose mask to reduce the inhalation of toxic metal ions and other forms of airborne toxicants, thereby serving as a mitigative strategy for inhalation toxicology in industrial and occupational settings in Nigeria.

CONTRIBUTION TO KNOWLEDGE: The chemical properties of a substance like chitosan may be utilized to enhance the safety performance of nose masks used to mitigate inhalation of industrial and environmental toxicants.

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