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Supplementary Materials

Moringa oleifera Seed Cake: A Review on the Current Status of Green Nanoparticle Synthesis

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Table S1. *Moringa oleifera* seed cake industrial applications patents.

Description	Patent Num.
Cosmetic use of a protein extract of defatted non-germinated *Moringa oleifera* seeds for the treatment of sensitive, sensitized, reactive, fragile and/or weakened skin and/or mucous membranes.	EP3737352A1
A *Moringa oleifera* compound extraction essence for hemorrhoids, that comprises leaf, root, and seed extracts.	CN105878599A
Cosmetic facial mask cream with anti-allergy, skin-cleansing and crease-resisting effects, with *Moringa oleifera* seed powder as the main component.	CN106309301A
Compound extracted *Moringa oleifer*a essence for treating male prostatitis, resorting to both leaves and seeds.	CN105943669A
Potato and *Moringa oleifera* seed health-care glutinous rice cake for healthy and economic nutrition.	CN106107512A
Application of *Moringa oleifera* seed extractive to cigarette filter stick	CN103271441A
Water treatment filter system in the form of a multi-layered *Moringa oleifera* seed cake filter, filled with seed cake, crushed and arranged in various layers in the filter.	WO2019071279A1

Table S2. Green chemistry of nanoparticles: advantages and drawbacks [108–112].

Advantages	Drawbacks
• Offers environmentally friendly and sustainable methods for synthesizing nanomaterials. Green chemistry utilizes bio-inspired alternatives like aqueous extracts from plants (e.g., leaves, fruits and seeds) or microorganisms (e.g., bacteria, fungi). This process eliminates hazardous chemicals, significantly reduces its carbon footprint, and boasts low cost, minimal pollution, and enhanced safety for both the environment and human health. • The bio-extracts can act as reducing agents, stabilizing agents, or templates for nanoparticle formation, significantly reducing hazards. The resulting nanomaterials are inherently biocompatible or less toxic. • Green synthesis methods are often simpler, requiring less energy (energy efficient) and fewer processing steps compared to traditional techniques. This translates to lower production costs, making them more commercially viable. • Green synthesis promotes sustainability by minimizing waste generation and often employing renewable resources. • These methods often utilize readily available natural resources or by-products, leading to lower production costs compared to traditional techniques that rely on expensive chemicals. • Biocompatibility due to the natural origin of the stabilizing and reducing agents used in the process makes the nanoparticles more suitable for applications in medicine, drug delivery, and bioimaging with reduced risk of side effects.	• Green synthesis methods can have longer reaction times compared to conventional techniques, which can be a significant drawback for applications requiring rapid synthesis or high production volumes. • Plants used in the process can vary in their properties due to factors like geographical location and seasonal changes. These variations in the source material can lead to inconsistencies in the yield, purity, and overall reproducibility of the resulting nanoparticles. • Working with microorganisms can require specialized expertise and facilities to ensure proper handling and maintain sterility throughout the process. • The process can sometimes lead to polydispersity of nanoparticles produced compared to conventional methods. • Achieving precise control over the crystallinity and morphology of the nanoparticles can be more challenging with green methods.