coatings

Editorial

Sustainable Textile Fabric Coatings: From Materials to Applications

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In order to meet the technical requirements, it is necessary to infuse new functions into textile fabrics due to the rapid advancement in the exploitation of textile-based materials in various industrial applications. Although textile fabrics have outstanding mechanical, economical, and light weight capabilities, their organic (natural or synthetic) origin encourages bacterial growth and causes easier combustion. Together with their sensitivity to harmful UV rays, this restricts textile fabric uses and their potential [1,2]. Therefore, there is a pressing need to include a variety of smart functionalities to provide comfort and open up new possibilities for new applications [3]. Thus, textile fabrics have to be treated through coating technology, with smart coating nanocomposites including various sustainable nanomaterials. In this regard, for example, to achieve strong flame retardancy, textile fabrics must be treated with a variety of ingredients, such as halogenated compounds, which are prohibited despite being highly effective flame retardants due to their toxicity and serious environmental issues [4]. The use of phosphorus–nitrogen-based compounds in various forms (organic and/or inorganic) led to good flame retardancy but had a negative impact on mechanical qualities. Following that, flame-resistant nanomaterials of various dimensions were developed, including spherical nanoparticles, graphene nanosheets, and nanofibers [5–7]. By adding coatings made of nanomaterial-based flame retardants to textile fabrics, good flame retardancy behaviour was achieved while also strengthening the textile fabrics [8–10]. It is interesting to note that complying with the United Nations' recent recommendations for sustainable development goals, which advise that the creation of coatings should predominantly come from renewable bio-precursors [11,12], Attia et al. reported multipurpose, environmentally friendly, and sustainable textile coating [9]. The discovered coating was produced with naturally occurring halloysite nanotubes and renewable molokhia extract in the presence of chitosan chains. Halloysite nanotubes were encapsulated in molokhia extract, evenly dissolved in chitosan solution, and then coated on the surface of linen textile fibres. The developed coating improved fire safety, UV protection and mechanical properties [9]. This is in addition to promising antibacterial behaviour to textile fabric surfaces as indicated in Figure 1.

In light of this approach, renewable, effective, and reasonably priced flame retardant, antiviral, strengthened, and antibacterial coating for textile materials has been recently developed and reported based on green synthesis approach as shown in Figure 2. In this sustainable coating, one-dimensional nanocomposite was developed from abundant halloysite nanotubes (HNTs) rennet casein as renewable a biopolymer, simply synthesized from a renewable source of cow's milk. The coated textile fabrics' flammability, poisonous gas suppression, reinforcing, antibacterial, and antiviral characteristics were all greatly improved [13]. Recently, textile fabrics have been used as substrate for fabrication of flexible sensor for accurate detection of toxic ions [14]. However, this required the incorporation of electrical conductivity and antibacterial feature to the fabrics used to afford safety and efficient performance. In addition, e-textiles, also referred to as electronic textiles, are composed of cloth but also contain built-in sensing and energy producing capabilities. Applications for e-textiles are numerous and expanding, including in the fields of energy storage, military, construction, automotive, and fashion, as well as in the areas of health monitoring, sports and fitness tracking, and fashion [15,16]. The capacity of a textile to be electrically conductive to transfer information or power is one essential prerequisite for these technologies [17]. Therefore, in this Special Issue, innovative and sustainable coatings for textile fabrics are proposed in order to achieve outstanding fire safety, antibacterial, self-cleaning, UV protection and hydrophobic properties. Additionally, innovation in electrically conductive textiles for electronic and sensor applications are invited, and biocompatible textile coatings for medical application of textile coatings are much appreciated.

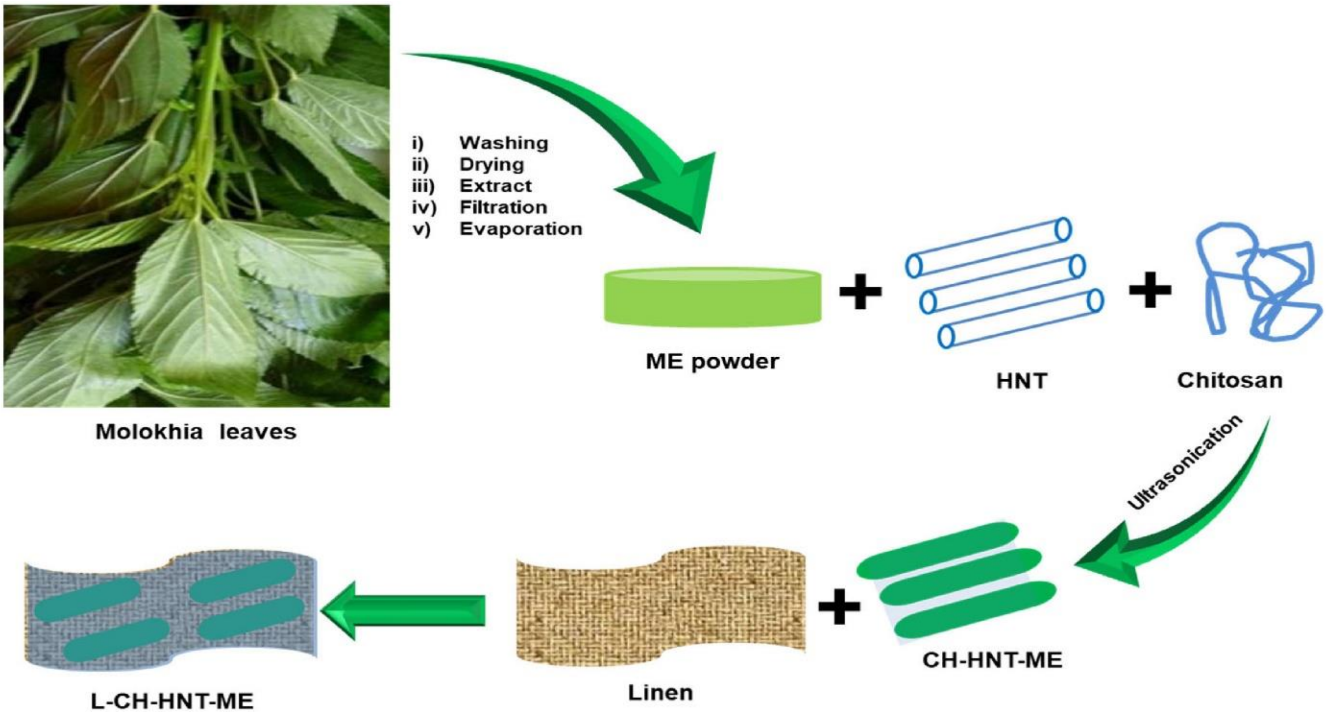

Figure 1. Schematic diagram representing the synthesis of green textile coatings CH-HNT-ME and their linen textile fabrics composite L-CH-HNT-ME, reproduced with permission [9]. Copyright 2022, Elsevier.

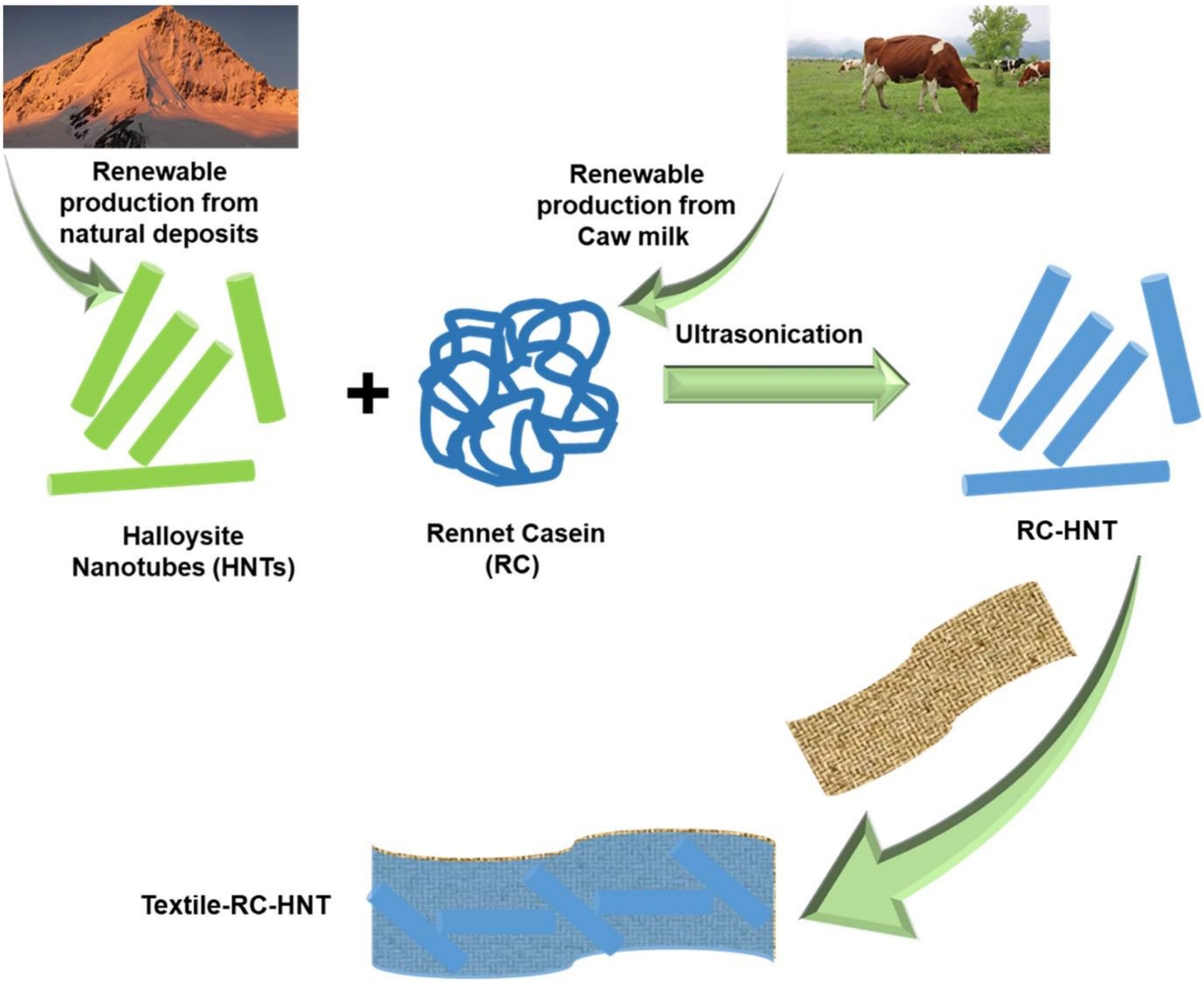

Figure 2. Schematic diagram representing the green synthesis of renewable textile fabrics coatings and their application on textile fabrics, reproduced with permission [13]. Copyright 2022, Elsevier.

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