Replacement of Standardized Primary Polyethylene Microbeads with Sustainable Biodegradable Alternatives

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Microbeads are widely used plastics which offer valuable properties that aid cosmetic products for exfoliation and scrubbing. Despite their size, they are currently having serious detrimental impacts on marine environments and food chains. Consequently, they are banned in many countries, necessitating the need for a suitable alternative. We proposed to synthesize biodegradable alternatives to polyethylene microbeads. Materials for synthesis were chosen for their sustainability and abundance from natural sources. Novel production methods were employed, involving the use of calcium alginate and starch polymers to create biodegradable microbeads of the correct size and shape for commercial use. The microbeads were subjected to a range of stability tests devised in line with standardized cosmetic production guidelines. Microbead stability tests included factors such as biodegradability, pH stability, thermal stability, photodegradation and solubility. Statistical analysis was used to determine potential change in microbead size and mass before and after testing. Visual analysis was used to determine the integrity of the microbeads before and after testing. Microbeads produced from a starch polymer process had the most potential for use in personal care and cosmetic products on the basis of their size, shape and ability to withstand a range of stability tests. The microbead production process offers the potential for further modification to improve their efficiency. The synthesis of our biodegradable microbeads derived from natural organic compounds offer the potential for the replacement of harmful polyethylene microplastics as low- environmental impact, sustainable and commercially feasible alternatives.