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Extraction, physicochemical characterization and evaluation of gum fraction of local myrrh (*Commiphora myrrha*) as binding agent in granule and tablet formulations

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In modern pharmaceutical dosage forms, excipients often fulfill multi-functional roles such as modifying release, improvement of the stability and bioavailability of the active ingredient, enhancement of patient acceptability and ensure ease of manufacture. New and improved excipients continue to be developed to meet these needs of advanced drug delivery systems. The objective of this study was to extract, characterize and evaluate myrrh gum as binding agent in granule and tablet formulations using paracetamol as a model drug in comparison with standard binders (PVP and Acacia). The gum fraction of myrrh was extracted, purified and characterized for its physicochemical properties. Batches of granules containing paracetamol were prepared using 2%, 5%, 7.5% and 10% w/w of myrrh gum and the reference binders. Tablets were evaluated for their mechanical and release properties. Result indicated myrrh gum exhibited high relative solubility in cold and hot water, low swelling power, acceptable moisture content, small total ash, no tannin and starch/dextrin content, mucilage with acidic pH and high viscosity, and excellent powder flow properties. Granules showed good particle size and size distribution, excellent flow and compressibility properties. The crushing strength, disintegration and dissolution times of the tablets increased with increased binder concentration while their friability decreased. All tablets passed standard specifications with respect to disintegration time, uniformity of weight, thickness, diameter, friability, hardness and tensile strength except friability at 2% binder and disintegration times at 10% myrrh gum and acacia. Comparison of the *in vitro* drug release showed tablets prepared with myrrh gum gave better drug release than acacia and comparable to PVP. This suggests that myrrh gum could be useful alternative binding agent especially when optimum mechanical strength and release required.

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Transdermal drug delivery and patient monitoring using hydrogel-based microneedles

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Here we describe unique microneedle arrays prepared from crosslinked polymers which contain no drug themselves. Instead, they rapidly take up skin interstitial fluid upon skin insertion to form continuous, unblockable, hydrogel conduits from attached patch-type drug reservoirs to the dermal microcirculation. Importantly, such microneedles, which can be fabricated in a wide range of patch sizes and microneedle geometries, can be easily sterilised, resist hole closure while in place and are removed completely intact from the skin. Delivery of macromolecules is no longer limited to what can be loaded into the microneedles themselves and transdermal drug delivery is now controlled by the crosslink density of the hydrogel system rather than the stratum corneum, while electrically-modulated delivery is also a unique feature. Since we have also shown that these microneedles efficiently imbibe skin interstitial fluid, employing them in blood-free therapeutic drug monitoring is another important potential application. This technology has the potential to greatly increase the range of type of drug deliverable transdermally and enhance therapeutic monitoring, with ensuing benefits for industry, healthcare providers and, ultimately, patients.

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