Low-melting pressure-sensitive adhesives for (trans)dermal patches preparation by 3D printing

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(Trans)dermal patches are designed to provide a prolonged drug delivery through the skin to achieve a local, regional or systemic effect. Usually, they are drug-in-adhesive systems, in which the drug is dispersed and/or dissolved in a pressure-sensitive adhesive (PSA) matrix, generally produced by a solvent casting method. This manufacturing approach requires expansive equipment that is not easily adaptable to the preparation of small or personalized batches.

This work demonstrated the feasibility of the extemporaneous preparation of PSA-based (trans)dermal patches by hot-melt ram extrusion 3D printing. This technology allows defining easily both the patch geometry and the dose according to patient's needs avoiding the manipulation (i.e., the dosage form cutting) by the patient or the caregivers. According to the approach proposed for orodispersible film [1], the patch preparation consists of three simple technological operations: i) the drug and the PSA components (at least a polymer and a plasticizer) are mixed in a mortar; ii) the mixture is fed in the chamber of the ram-extruder and heated at a suitable temperature; iii) the melt mixture is printed with the desired geometry (thickness: 50 µm) on the backing layer and coupled with the release liner.

Based on a previous experience, Eudragit (Eu) RL, RS or blends thereof plasticized with different amount of triacetin (40-60% w/w range) were tested as components of the PSA [2] while nicotine (NT) and ketoprofen (KP) were chosen as model compounds.

The printed patches were characterized in terms of shear adhesion and 180°-peel adhesion, other than drug content and drug release.

The results showed that patches with suitable adhesive properties can be printed using 40% w/w of triacetin. Both drugs did not compromise the patch adhesive properties, even if the shear adhesion was significantly reduced. Finally, the in vitro release studies showed that the EuRL/EuRS ratio impacted significantly on the release rate of both the tested drugs. According to the well-known characteristics of the two copolymers, the higher the concentration of EuRL in the matrix, the higher the release rate of both KP and NT.

Literature:

[1] U.M. Musazzi, Int. J. Pharm. 2018, 551, 52-59.
[2] G.M.G. Quaroni, Eur. J. Pharm. Sci. 2018, 111, 238-246