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## smartFilms® - a personalized delivery system for dermal application of amorphous drugs & cosmetic actives

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Films, also known as strips, wafers or patches are established in the market as a versatile delivery system. They can be employed for delivery of actives e.g. to the skin, and also to the mucosa of the mouth cavity. Application areas are pharmaceuticals, but also cosmetics and consumer care products. In general, the production technology is rather complex, the smartFilms® technology is the more straight forward alternative. Apart from loading the smartFilms® with nanoparticles (e.g. nanocrystals etc.), actives can be loaded in the amorphous state, which increases penetration into skin/mucosa.

Usually films as delivery system are prepared by solvent casting or hot melt extrusion [1]. In both methods the film forming process is performed in presence of all ingredients. So especially the active ingredients are exposed to stress (e.g. thermal or mechanical). Additionally the relative loading capacity of ingredients is limited below 30 % based of the total weight [1]. Also subsequent modifications of the films are restricted. These limits are eliminated by the new smartFilm® technology [2].

A film forming polymer, often synthetic, a plasticizer and the active ingredient(s) are at least required to produce film products by solvent casting or hot melt extrusion [1]. In contrast just cellulose based paper, the active ingredient(s) and no plasticizers are essentially required to produce film products by smartFilm® technology.

Paper as a porous carrier for loading is formed by a renewable and environment-friendly cellulose fiber network. An adjusted to the ingredients loading liquid (solution, suspension or emulsion) with the desired amount is added once or in multiple to the preformed carrier. Then the loading liquid is absorbed by the carrier. During drying the solvent or dispersion medium is evaporated and the ingredients are remained embedded in the pore matrix. Relative loading capacities of over 80 % related to the total weight were achieved. After loading and drying, the smartFilms® are cut into the final size and form. Both the film forming and the loading process are separated to give high flexibility in dosing. Various papers were used whereby tissue paper, filter paper and blotting paper were preferred due to their high absorbing capacity.

Besides other results, a mainly amorphous state of the loaded ingredients was found after loading with solutions. This amorphous state was investigated over 12 month by now after stor-



age under room conditions. A conversion into a crystalline form is suppressed by the porous structure of the carrier. Based on the amorphous state of the ingredients the bioavailability is increased.

smartFilms® are suitable for different kinds of dermal products for example cosmetics (e.g. face mask for wrinkle treatment), pharmaceuticals (e.g. glucocorticoid treatment) or medical devices (e.g. antiseptic treatment). The effect can be local and/or systemic. A reactivation after wetting the smartFilm® leads to a good adhesiveness to the skin. smartFilms® can be removed anytime from the application spot.

smartFilms® offer a simple delivery system for a dermal application of amorphous ingredients. The smartFilm® technology can be implemented on industrial scale based on the model of the newspaper industry with a conceivable output of millions. On the other hand smartFilms® can be manufactured flexibly at the point of sale e.g. in a pharmacy or a drugstore. So individual, personalized doses in user accepted appearance and taste are available in only little time.

#### References:

1. Borges, A. F. et al.: J. Control. Release. 2015, 206: 1-19.
2. Lemke, S. et. al.: German patent application. 2016 (submitted).

