NIREOS

HYPERSPECTRAL IMAGING FOR
TABLET IDENTIFICATION AND SORTING

The pharmaceutical industry deals with products which require consistent quality. To this purpose, in 2003 the European Medicine Agency introduced the Process Analytical Technology (PAT) to **control manufacturing processes** and in 2004 the Food and Drug Administration did the same in the US. Hyperspectral Imaging is particularly suitable as a PAT tool to guarantee that quality standards of the industry are met, providing a **non-invasive and accurate** spectral analysis in each point of the tablets under inspection.

Tablets are in general indistinguishable in the visible range, however with our HERA SWIR Iperspettrale (900-1700 nm) hyperspectral camera, it is possible to rapidly **characterize active pharmaceutical ingredients (API)** in tablets. In this application note three commonly used APIs are identified: ibuprofen, paracetamol, and acetylsalicylic acid (aspirin).

Additionally, the HERA SWIR can be used to distinguish tablets with **different concentrations** of the same API, as shown later in the work.

ADVANTAGES of HERA

- High Sensitivity
- Broad Spectral Range (900-1700 nm)
- High Spatial and Spectral Resolution
- Plug&Play
- Non-destructive measurements

ACTIVE PHARMACEUTICAL INGREDIENTS DISTINCTION

Active Pharmaceutical Ingredients (APIs) are the active components in a pharmaceutical drug producing the intended effect on the body. Tablets with different APIs are indistinguishable by the human eye (Figure 1 (a)), however they have characteristic spectral features in the infra-red region, which can be detected by the HERA SWIR, allowing tablet discrimination.
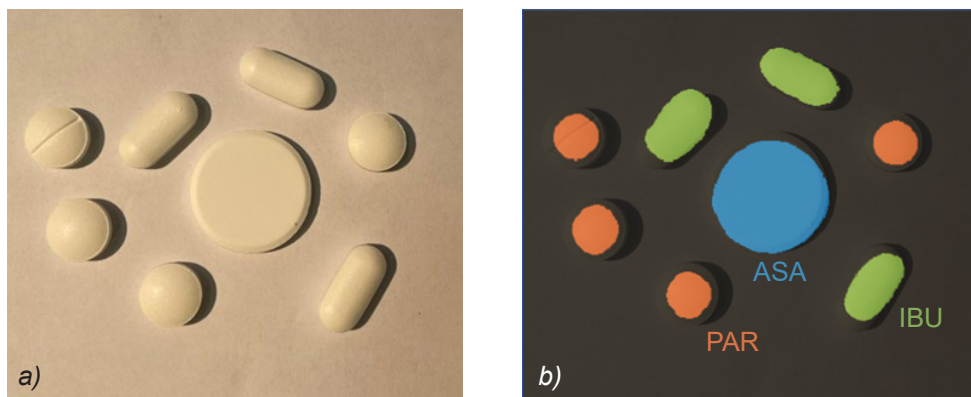

Figure 1, Distinguishing different active ingredients: (a) RGB image of the analysed tablets. (b) Result of tablet classification based on hyperspectral data, successfully identifying tablets containing ibuprofen (IBU), paracetamol (PAR), and acetylsalicylic acid (ASA).

Figure 1 (b) shows the results of a statistical algorithm applied to the SWIR hyperspectral data where pills with different APIs are clearly distinguished. Tablet discrimination has a major role in pharmaceutical waste management as well as detection of counterfeit drugs and quality checking processes.

API CONCENTRATION IN BLISTERS

The HERA SWIR Iperspettrale can also be used to distinguish tablets with different concentrations of the same API. It is also worth noting that pill identification can be performed while inside the blister. Figure 2 (a) displays the three blister packs under analysis. All of the pills inside have the same active ingredient (ibuprofen) but with different concentrations.

By applying an algorithm similar to the one used in the previous application, it is again possible to discriminate the different tablets (Figure 2 (b)). Interestingly, before performing the measurements, a pill from the third blister pack was placed in a void blister in the second pack. The result of this operation was impossible to distinguish by the naked eye, while the HERA SWIR was able to detect the tablet switch perfectly.
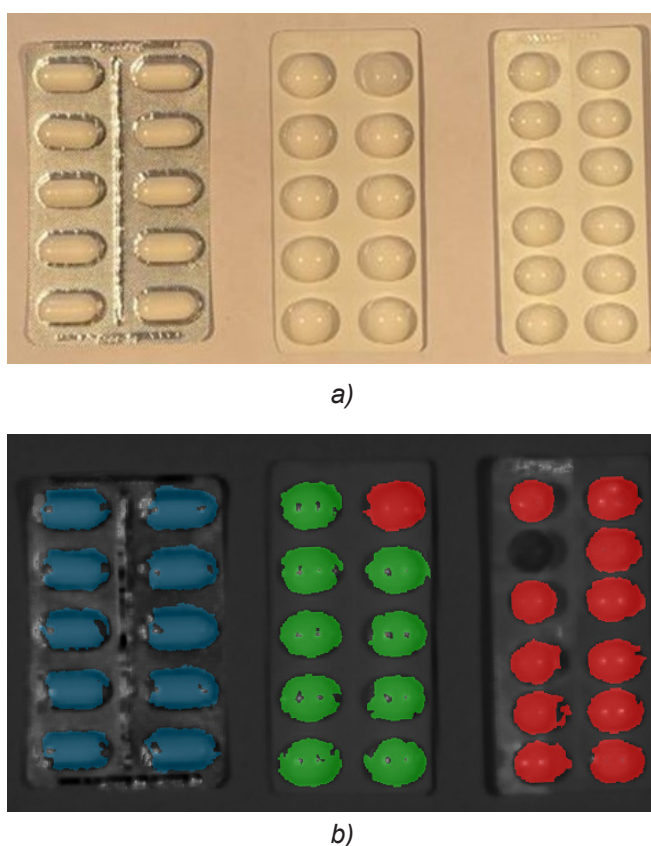

a)

b)

Figure 2, Distinguishing different concentrations of the same active ingredient: (a) RGB image of the analysed blisters. (b) Result of tablet classification based on hyperspectral data. Tablets with different concentrations of ibuprofen are clearly distinguished, including misplaced and missing tablets.