

# Vibrational Spectroscopy Facility

APPLICATION NOTE 01 by Dr Janine Colling

## Authentication of pharmaceutical products based on their chemical composition

### Introduction

Pharmaceutical products are subject to counterfeiting as tablets with different active pharmaceutical ingredients may have a similar appearance (Fig 1). Application of NIR hyperspectral imaging can assist with the authentication of tablets based on the chemical differences. The tablets in Figure 1 contain either/ or both Paracetamol and Acetylsalicylic acid. Two tablets containing Ascorbic acid (VitC) and a peppermint sweet was used to test whether the model could identify these products.

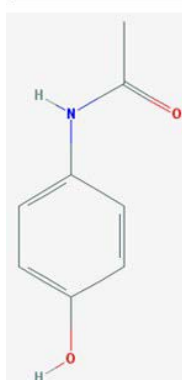
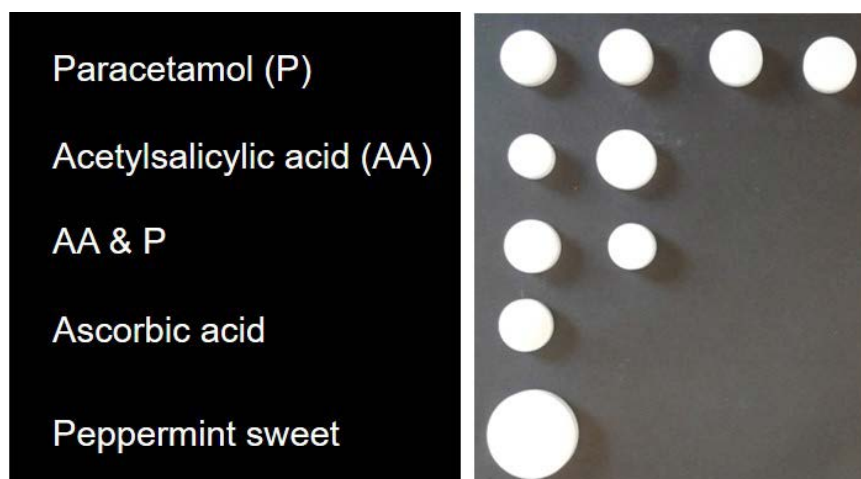
**Figure 1:** The visual appearance of white tablets can make it hard to discern their authenticity.

Tablets in row 1 contain Paracetamol from four different brands. Row 2 contain Acetylsalicylic acid (from two different brands); row 3 contains both Acetylsalicylic acid and Paracetamol (two different brands). The tablet in row 4 contains ascorbic acid and in row 5 a peppermint sweet was included. The chemical structures for the three compounds (AA, P and ascorbic acid) are illustrated.

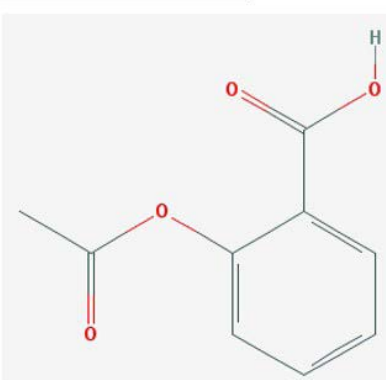


### Method

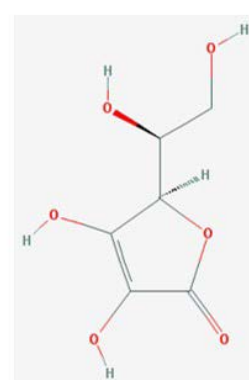
Tablets were imaged with the SWIR hyperspectral imaging system. A PLS-DA model was generated to distinguish between tablets. An independent test set was imaged to test the model.



Paracetamol



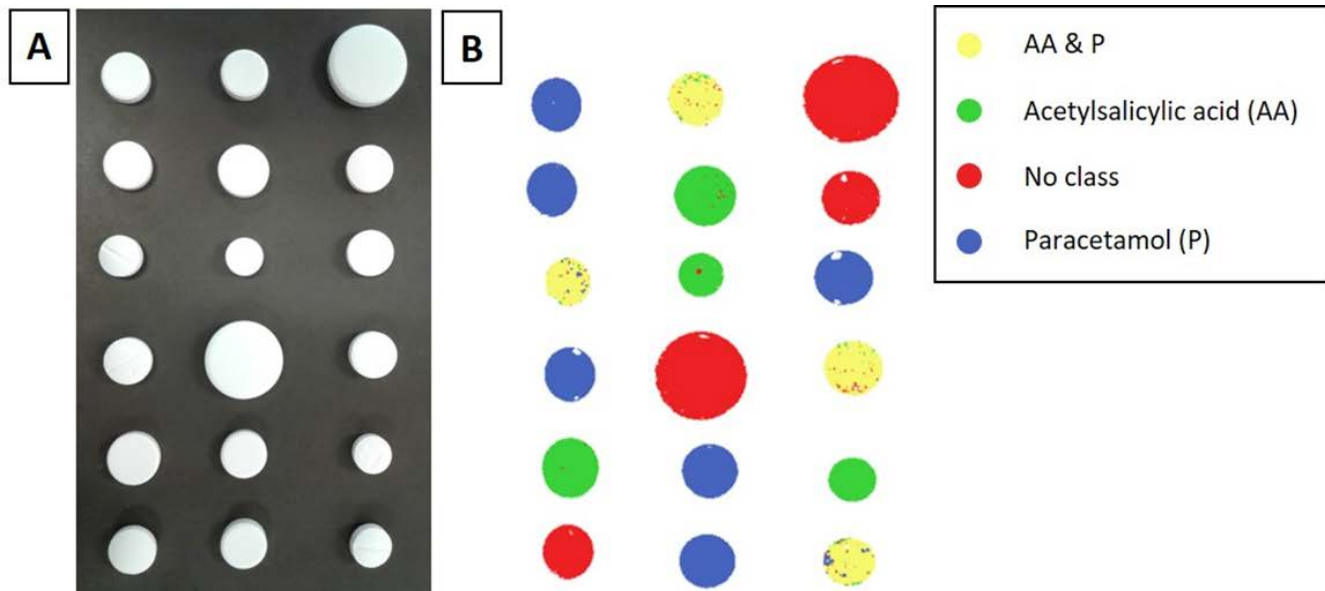
Acetylsalicylic acid



Ascorbic acid

## Result

The tablets were randomly laid out (Fig 2A) and imaged with the SWIR camera. By using the Breeze program (Prediktera), the PLS-DA model could successfully classify the tablets into four categories (Fig 2B). The two samples which did not contain either of the active ingredients were classified in the 'No class' category. This technique can be used to build models to identify products based on their chemical contents.



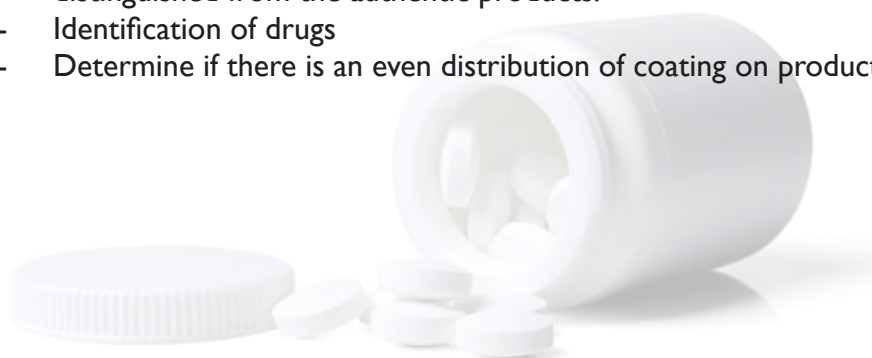
**Figure 2:** Colour image and prediction maps obtained using a PLS-DA classification model. (A) Colour image for the various tablets showing that they have a similar visual appearance. (B) Prediction image of tablets generated with Breeze software. The colours in the figure legend correspond to specific categories (Paracetamol, Acetyl salicylic acid or AA&P) indicated in the predicted image.

## Advantages of NIR hyperspectral imaging

- Fast - one image can be acquired in less than 1 minute
- Non-destructive
- Requires little to no sample preparation
- Reduced cost compared to conventional methods
- Increased sample throughput
- Allows for real-time classification of the products
- Does not require the use of chemicals

## Potential applications

- Verification of pharmaceutical products, which can't be visually distinguished from the authentic products.
- Identification of drugs
- Determine if there is an even distribution of coating on products



**Interested  
in the use of  
hyperspectral  
imaging?**

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or

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Vibrational  
Spectroscopy  
Website:

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