Licia Dossi #07

Licia Dossi. 'Chemistry of Colours'. 2023.

About the Exhibit

'Chemistry of Colours'
The model on display is in the form of an ethylene molecule which just happens to take on the form of a dog with its hydrogen, carbon and nitrogen components. Contained within the spheres are molecular diagrams of some of the chemicals that the device is intended to detect. Included in the connecting tubes are also the proper names of these substances. On the 'nose' of the dog is one of the actual detector chips used in the device. The model stands in top of a display that shows the changes in the colours of the chip over time as it engages in its detection.

About the Research

Law Enforcement Agencies around the world are under constant pressure to control the movement of criminal chemical substances more efficiently. This has led to a growing demand for detection equipment that is quick and easy to use, low cost to produce and maintain, and with the flexibility to identify a range of different substances.

Cranfield University have collaborated on the development of CRIM-TRACK, a prototype 'mechanical sniffer dog' that can support the fight against organised crime and terrorism and contribute to global security. The

sniffer device is designed to detect traces of illegal drugs and explosives, and the chemicals used to make them, as parts-per-trillion, in near real-time and with no operator threat from contact.

It works by sniffing the air to detect the vapours given off by the chemicals. The device is loaded with a microchip printed with preselected dyes based on their chemo-selective nature. Using a technique known as colorimetric sensing, these dyes will undergo colour changes if exposed to vapours from the corresponding chemical. This colour change is captured by an algorithm developed by the team.

The data collected by CRIM-TRACK sniffer trials are organised into datasets, visualised in various difference maps for inspection and interpretation of results. Machine learning models are used to learn the signature of the unknown chemicals and perform the detection.

Dr Licia Dossi, a materials scientist and Senior Lecturer at Cranfield University's Centre for Defence Chemistry, worked together with Dr Mogens Jakobson and his team at the Technical UnIversity of Denmark (DTU) and CRIM-TRACK Aps, a spin-off company of DTU, to produce a compact, user friendly and portable prototype. Further development towards the optimisation and commercialisation of the CRIM-TRACK detector was undertaken through a Cranfield sponsored PhD studentship and additional funding from the Danish Defence Ministry.

The CRIM-TRACK project has specifically focused on areas where there is a growing safety risk to society, and the benefits of its use at locations such as airports and border inspection stations are clear to see. Current proposals for alternative uses for the sniffer device include both the detection of infectious airborne diseases and the presence of pesticides in National Archives items. The technology could also be applied in areas such as food production, manufacturing processes and environmental monitoring - to name but a few.

About the Researcher

Dr Licia Dossi is Lecturer in Defence Chemistry at Cranfield University and RSC Chartered Chemist and Chartered Scientist, with expertise in synthetic polymer chemistry and explosives chemistry gained from 30 years' experience in UK and European Academic institutions. She graduated with an MSc in Chemistry from Pisa University, Italy and received her PhD in Biomaterials from Brescia University Italy.

She was a Research Assistant at Pisa University, the Italian National Research Council and Genoa University in the synthesis of new polymeric systems for a variety of applications. Her research contribution on the synthesis of liquid crystalline polymers developed in Pisa University is often cited worldwide. Licia moved to Bristol University UK in 1998 as Research Assistant with a three year ESPRC grant in polymers and then took a career break for her young family until 2008 when she joined Cranfield University as Research Fellow. She became Senior Research Fellow in 2015 and then Lecturer in Defence Chemistry in 2018.

Licia is currently part of the synthesis and formulation group at the Centre for Defence Chemistry at Shrivenham and has a recognised teaching status for high education. She delivers lectures at Master and PhD levels on a variety of themes. She is active member of the Centre of Excellence in Energetic Materials Synthesis group and has an important national and international networking. She is an active researcher and co-author in more than 55 published papers/conference proceedings, 2 international patents and 1 book. Cited papers 78, h-index 5 (as from 18.08.2019).

www.cranfield.ac.uk/case-studies/crim-track

Cranfield University video of the project:

www.cranfield.ac.uk/centres/centre-for-defence-chemistry

www.cranfield.ac.uk

Scan the QR Code to learn more about this research.

Artwork fabrication by Paul Malone