

Laser spectroscopic analysis in atmospheric pollution research

Polycyclic aromatic hydrocarbons (PAHs) occur in oil, coal and tar deposits, and are produced as byproducts of fuel burning (whether fossil fuel or biomass). At elevated levels, these pollutants are of concern due to their potential carcinogenicity. In general, more PAHs form during incomplete combustion, when materials burn at low temperatures, such as in wood fires or cigarettes.



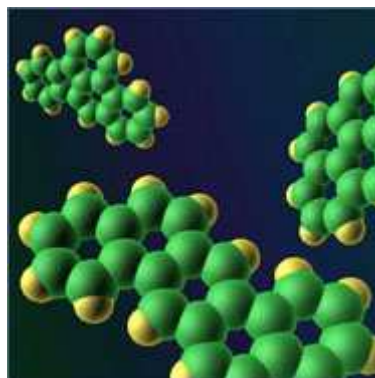
Professor Egmont Rohwer

Dr Egmont Rohwer, professor at the University of Pretoria's Chemistry Department and a CSIR National Laser Centre rental pool programme grant-holder, is involved in research into a novel method of monitoring atmospheric PAHs. The rental pool programme gives South African tertiary education institutions access to an array of state-of-the-art lasers, laser diagnostic equipment and laser laboratories.

The professor's co-researcher is CSIR senior researcher Patricia Forbes, who is working towards her PhD. Rohwer explains, "We will investigate the laser-induced fluorescence properties of PAHs absorbed into silicone rubber traps from the gas phase in order to assess the viability of utilising the technique as a novel means of PAH monitoring. I am glad to say that studies in this regard to date have yielded promising results and we are confident that the research project will be concluded at the end of this year having achieved its objectives. I am proud to say that the silicone rubber traps were developed by my analytical chemistry group."

Rohwer explains, "PAHs are pollutants generated during combustion processes, which are of concern as a result of their toxicity. Organic air emissions are generated by a number of anthropogenic activities, including industrial processes such as combustion and incineration, as well as from biogenic sources. Environmental concerns regarding the effects of these emissions have resulted in the development of more stringent legislation to minimise emission levels, as evidenced by the National Environmental Management: Air Quality Act (No. 39 of 2004). In order to effectively implement this legislation, it is imperative that accurate and widespread atmospheric monitoring is done for a wide range of pollutants."

Given that most people are exposed to PAHs when they breathe smoke, vehicle emissions or industrial exhausts, Rohwer's work could be beneficial to the industrial and environmental sectors of South Africa and it may also find application in occupational hygiene monitoring. However, Rohwer says, "Many useful products such as mothballs and creosote wood preservatives contain PAHs. It is important for people to understand that the presence of harmful chemicals does not necessarily imply that these are dangerous; it is the quantity that is of importance."



Polycyclic aromatic hydrocarbons

Aptly put, Rohwer says, "The fields of chromatography and mass spectrometry are to chemistry what the telescope is to astronomy or the microscope to biology. Besides its obvious benefits, analytical chemistry will also help researchers form a better understanding of the human body and mind."