The Environment, Health and Food Safety Impact of Microplastics

This project brings scientists and experts across IUPAC Divisions together to tackle the microplastics issue from published results and data in literature. Plastic is the most important material (iron and steel too) in terms of their environmental impacts in a UNEP (2010) report. Unintentional breakdown debris (from 1 µm to 5 mm) of plastic is termed microplastics. The issue of microplastics in the environment has recently become the media focus as they are regularly ingested by people worldwide. However, their impacts on the environment, human health, or food safety are not fully understood yet.

Due to the nature of the problem, the high-risk level, and the wide distribution (it adversely affects billions of people and the whole biosphere) of microplastics, it is necessary for polymer experts, analytical chemists, environmental scientists, and diversified stakeholders experts from all areas to work together on this important, interdisciplinary mission. The consortium will i) collect the literature and data from literature, ii) model the distribution of microplastics in the environment, iii) measure the consequences to biosphere and the environmental impact, iv) degradability, bioavailability, and toxicity, v) risk assessment, and conclusions and recommendations.

For more information and comments, contact Task Group Chair Weiping Wu <Weiping.Wu@city.ac.uk> | https://iupac.org/project/2019-026-2-600

Structure-based nomenclature for irregular linear, star, comb and brush polymers with different types of constitutional repeating units (CRU)

This project is intended as a complement to the project 2013-031-3-800, "Structure-based nomenclature for irregular linear, star, comb and brush polymers," which provides guidelines for the nomenclature of linear and branched polymers with three or more blocks that are of identical constitutional repeating units (CRU). This new project will provide guidelines for the nomenclature of the same type of polymers but, importantly, it will extend the nomenclature so that polymers containing more than one type of CRU can be easily and uniquely described.

In research and in industry, there is a need for clear guidelines for the nomenclature of such materials, both for articles and patents. On the one hand, recent developments in "controlled" polymer chemistry allow for greater control over polymer structures, and on the other hand, an increasing market demand for more complex materials, have together meant that polymeric structures are more complex and better defined. The current IUPAC recommendations can deal with most structures, but are increasingly becoming outdated, and in some cases, surpassed by the complexity of recently reported polymer skeletons. Source-based nomenclature has recently undergone a massive update. It can deal with most common structures; however, it suffers from its intrinsic incapability to deliver absolutely unique names for unique structures. This project will deliver recommendations for structure-based nomenclature which will be able to uniquely identify polymers and copolymers which contain a multiple number of CRUs in complex linear, star, comb and brush-based structures.

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Preparation of the 5th Edition of the IUPAC Green Book

The first IUPAC *Manual of Symbols and Terminology for Physicochemical Quantities and Units* (the Green Book) of which this will be the direct successor, was published in 1969, with the object of "securing clarity and precision, and wider agreement in the use of symbols, by chemists in different countries, among physicists, chemists and engineers, and by editors of scientific journals." In 1988, it underwent major extension and revision and was given the simplified title *Quantities, Units and Symbols in Physical Chemistry*.

The 3rd edition (first released in 2007) and the 4th currently (to be released this year) have a significantly extended index that provides a dictionary of terms and symbols and useful conversion tables. Information in the Green Book is synthesized from IUPAC, IUPAP, and ISO. The 3rd edition has been available as a PDF since 2008. With this 5th edition, the contents will be again reviewed, to identify which aspects should be retained (*e.g.* should all the data tables be retained), what areas need to be revised, enhanced or deleted, and which topics needed to be added (*e.g.* perhaps less emphasis on data tables, and more information on

NMR, nanoscience, computational chemistry and simulations, non-equilibrium thermodynamics and statistical mechanics etc.).

Digitally Native Book

The task group plans to evaluate the methodology used with the preparation of the translations of the 3rd Edition which created an XML version of the Green Book and tested the software infrastructure to use this XML version to derive the print versions. This would enable the production of more versatile Web based versions of the Green Book in addition to the printed book. This would also facilitate semantically marked up content very suitable to link to the evolving IUPAC Gold Book and provide an online resource to be used by others in generating correct text for other publications which use the material in the Green Book (*i.e.* symbols and units).

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Nomenclature and Associated Terminology for Inorganic Nanoscale Particles

Nanoscale particles are receiving increased attention worldwide, with numerous commercial and technological applications leading to significant societal impact. There is a steady increase of publications on such materials, and a growing interest in the application of these materials and their associated chemistries to new fields. Particles, in general, are an enormous contributor to international commerce, advanced technologies, science, and the chemical industry at large. Almost all chemical and manufacturing processes include the use of, or creation of particles.

Currently there is not an established nomenclature system for describing particulate materials. Particles, much like polymers, can have similar chemical identities, but due to particle structure, size, and distribution of properties they can have distinct behaviors. The lack of proper naming conventions frequently leads to confusion regarding the type of particle being described or used in literature and in commerce. Particles are extensively exploited in the chemical and material science industries, and growing regulatory monitoring activities predicate a need for procedures for naming particulate materials in a meaningful and systematic manner. Notably, these materials lie in an area that is not explicitly covered by the nomenclature rules for inorganic or organic compounds. Hence, there is a need to develop IUPAC recommendations for the nomenclature and associated terminology for particles and populations of particles.

This project will begin the development a framework for the nomenclature of inorganic particles, building upon and refining existing principles derived from polymers, ongoing efforts on carbon nanotubes, ISO terminology, and opportunities with InChI, in addition to developing new frameworks for future materials. The intent is to develop conventions for the clear description of inorganic particles, their modifications (surface and bulk) and populations.

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Per and polyfluroalkyl substances in the environment and their impacts on human health

Per- and polyfluoroalkyl substances (PFASs) are a major environmental concern globally due to their widespread usage and persistence. They found widespread applications in industry due to their unique chemistry of having both hydrophilic and hydrophobic (surfactant-like) properties. However, concerns about these chemicals have been growing due to their long-term persistence in the environment, potential for bioaccumulation and toxicity to human and ecological health. Consequently, two PFASs (PFOS, PFOA have already been listed on the Stockholm Convention for POPs, whereas the third compo (PFHxS) is about to be listed. This means the emerging economies will have to respond to this issue in near future.

In 2001, when it was realized that PFASs are bioaccumulative, contrary to previous assessment, the manufacturers such as 3M and DuPont voluntarily withdrew their manufacturing of PFOS. At that time China and India took up the production of these chemicals and hence the problem had virtually shifted to emerging economies. The true extent of PFAS problem has not been recognized in the emerging economies and this may be a “sleeper” issue.

Since 2000 a number of studies have been carried out in USA including USEPA’s exposure study (2013-15) involving > 36000 samples which showed that