quality biodiesel from the unused oils without complicated upstream and downstream processing. Furthermore, high quality glycerin and vitamin E were simultaneously produced during the regeneration of the anion-exchange resin.

[KN.05] Dr. Glenn Hurst
University of York, UK

Abstract not available at the time of print

[KN.06] Nicholas Turner
University of Manchester, UK

Design and evolution of new biocatalysts for organic synthesis

This lecture will describe recent work from our laboratory aimed at developing new biocatalysts for enantioselective organic synthesis, with emphasis on the design of in vitro and in vivo cascade processes for generating chiral pharmaceutical building blocks. By applying the principles of 'biocatalytic retrosynthesis' we have shown that it is increasingly possible to design new synthetic routes to target molecules in which biocatalysts are used in the key bond forming steps [1].

The integration of several biocatalytic transformations into multi-enzyme cascade systems, both in vitro and in vivo, will be addressed in the lecture. In this context monoamine oxidase (MAO-N) has been used in combination with other biocatalysts and chemocatalysts in order to complete a cascade of enzymatic reactions [2-4]. Other engineered biocatalysts that can be used in the context of cascade reactions include □-transaminases [5], ammonia lyases [6], amine dehydrogenases [7], imine reductases [8], and artificial transfer hydrogenases [9]. We shall also present recent work regarding the discovery of a new biocatalyst for enantioselective reductive amination and show how these enzymes can be used to carry out redox neutral amination of alcohols via 'hydrogen borrowing' [10].

[KN.07] Prof. Dr. Christian Oliver Kappe
University of Graz, Austria

Making pharmaceuticals in flow

Enhanced heat and mass transfer, precise residence time control, shorter process times, increased safety, reproducibility, better product quality and easy scalability are just a few of the advantages of flow chemistry and reason for the increasing implementation of continuous processes not only in academia but also into the fine chemical manufacturing sector. Notably, to make a process greener and more sustainable becomes eminently important when going from lab-scale to production scale. In this presentation, the question to which extent continuous flow processing has an impact as green technology, in particular on the synthesis of active pharmaceutical ingredients (APIs) on manufacturing scale, is discussed. Based on the principles of both green chemistry and green engineering selected continuous processes are evaluated.

[KN.08] Prof. Dr. Fabio Aricò
Ca' Foscari University of Venice, Italy

Chlorine-free chemistry via dialkyl carbonates

In the last decades, due to the increasingly stringent environmental regulations, companies' priority has become the conservation of high process performances by means of eco-compatible methodologies. In this view, green solvents and reagents dialkyl carbonates (DACs) have been extensively investigated as possible alternatives to some chlorine reagents (methyl and acyl halides, phosgene) and solvents (dichloromethane and chloroform).

In this talk the following aspects and applications of chlorine-free chemistry via DAC will be addressed:

<u>Heterocycles synthesis</u>: DACs chemistry has been proved efficient in the preparation of numerous 5- and 6-membered heterocycles including: furan systems, pyrrolidines, indolines, isoindolines, 1,4-

dioxanes, piperidines and cyclic carbamates. In these reactions, the selected DAC acts as sacrificial molecule being completely converted, at the end of the reaction, into CO_2 and an alcohol. Chlorine and carbonate moieties can both be used as sacrificial groups in nucleophilic displacements, however the latter do not produce salts and harmful wastes to be disposed of and display low toxicity and high biodegradability.

Renewables upgrade: The reactivity of isosorbide with DMC is an industrially relevant process as it can lead to the formation of dicarboxymethyl isosorbide, a potential monomer for isosorbide-based polycarbonate, and dimethyl isosorbide, a high boiling green solvent. The peculiar reactivity of isosorbide via chlorine-free DMC-based approaches is paving the way to several industrial potential applications.

From war chemicals to green reagents: Mustard gases are vesicant and blistering agents that have been sadly used in several chemical warfare. The toxicity of these compounds is strictly related to their high reactivity. Sulfur and nitrogen (half-)mustard carbonate analogues are a new class of compounds, easily synthesized via DAC chemistry retaining the reactivity of mustard gases, but that are not toxic for the operators or the environment. Their reactivity as novel, green electrophiles and their possible potential application as green reagents will be discussed.

[KN.09] Prof. Jan Kratzer
TU Berlin, Germany

Starting up in the Age of Sustainability

Starting up business endeavors is increasingly linked with demands of sustainability in all branches. However, the current world is still far from reaching the 17 goals for sustainable development as formulated from United Nations. The overwhelming majority of entrepreneurs probably agrees that our social well-fare, our economic stability all our life quality depends on taking these goals serious and translating them into future business activities. However, reality is still miles away.

There are two major dilemmas for startups in chemistry translating sustainable demands into business. The first is the unique start up process in natural and life sciences itself. Becoming a scientist or engineer is not naturally linked to education in sustainable entrepreneurship, sustainability is not recognized as sensemaking vehicle in enterprises and that creating authenticity as business requires sustainability as driver. In addition, development efforts in chemistry hardly integrate users, who increasingly demand sustainable products and processes.

The second one is that measuring sustainability impact is inherently difficult for mature organizations. Measuring it for startups that have limited time, financial and human resources and additionally fast changing business models makes this almost unsolvable. However, finding investors is increasingly linked to be able to measure its own sustainable footprint. In the future attracting investments from fonds or via crowdfunding will strongly be linked to transparent sustainable impact measurements.

[KN.10] Prof. Dr. Janet L. Scott
University of Bath, UK

Appropriate material lifetimes - functional materials from cellulose

There is an urgent need to match material lifetimes and end-of-life fate to the use to which the material is put, i.e. to engineer materials with "appropriate" lifetimes. For example, a polymer to be used in the manufacture of packaging that can be collected and recycled must be robust enough to withstand repeated mechanical recycling processes without loss of material properties, but it may be beneficial for a polymer intended for single-use applications to be biodegradable if pollution by persistent plastics is to be avoided.

Cellulose, one of Nature's most abundant polymers, is a robust material, but can be challenging to process, particularly into materials that could replace "plastics" in some applications. Here we will describe examples of cellulose based materials as alternatives to fossil carbon derived polymers, particularly in applications where recovery and reuse or recycle are not straightforward, or even impossible.

Using chemistry and processes designed to be scalable, we prepare cellulose based:

- microbeads, with applications in consumer products and potential to replace persistent