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Smarter and greener chemical process by integrated microfluidics with innovative system design concepts

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During past decades, the concept of microfluidic chemistry received increasing attention and attempts to develop environmentally benign chemical processes were intensified. The new conceptual devices must enhance their intrinsic advantages to perform any smarter and greener process. In here, we present various automated total processes for the generation of the toxic and carcinogenic reagents, its purification, and its utilization for a desired synthesis followed by quenching of the unused, which are conducting in a micro-total envelope system (μ-TES) with no exposure to the harmful or the unstable chemicals. This new microfluidic platform for diazomethane, isocyanides, diazoacetate, chloromethyl methyl ether compounds were successfully utilized and does not require any additional workup and column chromatography, which remove the safety issues involving risky compounds in the chemical processes. Various unique microseparators were developed on the basis of different principles such as liquid-liquid extraction, liquid-gas distillation, membrane separation in purifying the generated reagents. This total process concept was applied to carcinogenic, explosive, toxic or noxious regents. In addition, the unstable intermediate with short-life time was generated and reacted with an infused reagent, which performed within 330 μsec for outpacing Fries rearrangement through microfluidic rapid mixing. Promisingly, those approached must be useful in the areas of drug discovery, natural products, ion-exchange membranes, materials synthesis and biology.

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Two novel luciferin-luciferase systems: Higher fungi and earthworm *Fridericia*

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Hundreds of species of bioluminescent animals, fungi, protists and bacteria are known, and there are estimated to exist ~40 different chemical mechanisms underlying the generation of "Cold Light". In all known cases, the energy required for light production is generated by the oxidation of a small organic molecule, luciferin, catalyzed by a specific enzyme, luciferase. In some cases, luciferin and luciferase form a stable functional complex termed photoprotein. To date, the structures of 9 natural luciferins are known, 2 of which were identified in 2014 and 2015. Discussed will be structure elucidation of novel luciferins, as well as experimental data and theoretical considerations concerning their light emission mechanisms.

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