PhosporCycle: Thermochemical Phosphorus Recovery and Low-Cost Rapid Determination

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The aim of the project is the recovery of phosphorus by a thermal process, as the primary sources of phosphorus will be depleted in the next few years. Our educt is mainly sewage sludge ash, but also for example lime/cement kiln dust are used as additives. The InduCarb operates on the principle of an induction furnace, in which an alternating current with high frequency is sent through the coil. When an electrical conductor is placed in the resulting magnetic field, it gets heated up by eddy currents. Sewage sludge ash is filled into a graphite crucible. This crucible is transferred to the reactor where it gets heated to about 1 500°C and held for a certain time at this temperature. At about 1 300°C, the phosphorus gets reduced by carbon monoxide and carbon and diffunds in his elemental form out of the reactor. We transfer this gaseous intermediate product over into a scrubber, where it forms industrially exploitable phosphoric acid with water. To check the quality and quantity of our method, we needed a low-cost rapid detection, which provides reliable results with little effort. Therefore, we used the total phosphorus determination by the molybdenum blue method with our self-built photometer. It is based on resistance measurement. The construction of the photometer was found to be particularly tricky due to the requirements for the electronics (accuracy) and specifically to the cuvette holder. The main part of our detection is a photo resistor (LDR) – it changes its electrical resistance as a function of the irradiating light intensity. So the voltage is depending on the concentration of the introduced solutions. Calculations showed extremely low detection and determination limits for our PhosPhot, which are comparable with those of a commercial photometer.

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