UDC 547+66.09

The separation of microalgae produced for oil production from substrate solution

Hodai, Zoltan, Ph.D.-student
Horvath, Geza, Ph.D., docent
Bocsi, Robert, Ph.D.-student

University of Pannonia, Department of Chemical Engineering Science
(Hungary, H-8200 Veszprem, Egyetem str. 10)

The utilization of microalgae carbon dioxide interception is an important area of international research and development. The absorption of certain technological exhaust gases is possible with the photosynthesis of microalgae. The absorption of carbon dioxide can even reach the value of 100 t/ha. C_{16}-C_{22} esters are formed in certain alga cells which can be used for the production of biodiesels. This method is thus capable of the production of fuels from renewable sources. Algae production is the most promising solution amongst the alternatives because of its specific area necessity and high reproduction rate. We test available and applicable species at the local climatic conditions. Research is being carried out in carbon dioxide absorption from technological flows at the Department of Chemical Engineering of the University of Pannonia. The absorption of carbon dioxide and the reduction of the release of other pollutants (wastewater) with microalgae are examined.

The harvest can be carried out with microfiltration, centrifugation, flocculation, with sonochemical techniques, or with any other techniques that are under development [1, 2]. Presently, the combined separation technology appears to be economically feasible. The combination of flocculation and microfiltration results in a separation of appropriate speed, quality and cost The flocculation of the algae can be achieved by two means. Firstly, with the so-called autoflocculation technique, secondly, by chemical means, e.g. by the addition of aluminum sulfide, iron chloride, or iron(III)sulfate to the solution, which results in the coagulation of the algae [3, 4, 5]. Of the two methods, chemical flocculation is capable of increasing the alga concentration more efficiently. The simplest way to achieve the phenomenon of autoflocculation is by the cessation of the carbon dioxide feed. When ceasing the carbon dioxide feed, the slow sedimentation of the algae commences. The roles and the effect on sedimentation of in-sprayed oxygen, irradiated light and temperature are not yet clear. The examination of the phenomenon is the subject of present laboratory measurements. The analytics of the chemical flocculation experiments: The effect of the flocculants was followed by Particle Charge Detector (PCD) measurements and defined with the clarification experiments. These also make the interpretation of the results difficult. (Because of the great amount of experimental data and the complex correlation between them, correlation analysis needed to achieve better understanding.)

The autoflocculation experiments show satisfactory results, but because of the low settling speed we have not adapted the procedure in practice. The need of chemical substances have been optimized (the composition of the flocculation agent is the variable of the separation method). ((Use $NaOH$ 10 -11 pH + 39 – 65 cm^3 Poly-DADMAC (Poly-Diallyldimethylammoniumchloride) + 1,2 – 2,4 cm^3 $Fe_2(SO_4)_3$) / 1 dm^3 algae solution.) Figure 1 shows the results of the flocculation experiments.

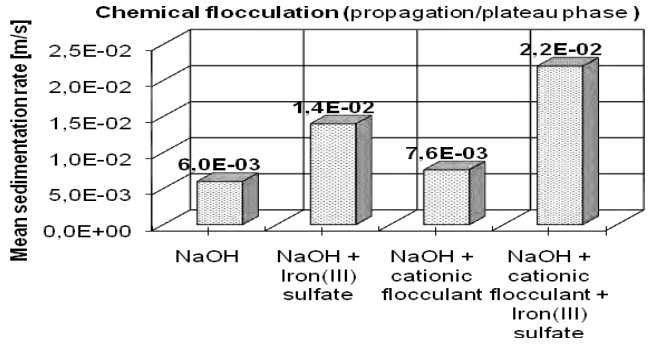

Fig. 1 Results of the flocculation experiments

We acknowledge the financial support of this work by the Hungarian State and the European Union under the TAMOP-4.2.1/B-09/1/KONV-2010-0003 project.

1. G.A. Shelef, A. Sukenik, M. Green, Microalgae Harvesting and Processing: A Literature Review, Report, Solar Energy Research Institute, Golden Colorado, SERI/STR-231-2396, (1984)
2. E. Poelman, N. De Pauw, B. Jeurissen, Potential of electrolytic flocculation for recovery of micro-algae, Resources Conservation and Recycling, 19, (1997)
3. de Godos I, Bioresource technology, 10-16, (2010)
4. Ny. Uduman, Y. Qi, M. K. Danquah, A. F. A. Hoadley, Chemical Engineering Journal, 162-935, (2010).
5. R. M. Knuckey, M. R. Brown, R. Robert, D. M. F. Frampton, Aquacultural Engineering, 35-300, (2006)