

Biotechnology at the junction of life and technology sciences

– an interview with Professor Katarzyna CHOJNACKA, Vice Chairman of the “Biotechnology and highly processed chemicals” Topic at the 7th Chemical Technology Congress in Cracow

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Professor, being Vice Chairman of the Biotechnology and highly processed chemicals Topic at the 7th Chemical Technology Congress, you are interested in the level and development of this interdisciplinary field of science. What do you think the level of biotechnology in Poland is? What is the contribution of the chemical sciences to the formation of this field?

I would place biotechnology as an interdisciplinary science at the junction of life and technology sciences. Research and development works require fundamental works, that is, in this case the works mainly of biological nature. If a new production method is planned to be developed, then technological research becomes necessary. So, the role of chemical technology is very important here.

The worldwide practice shows that researches at the junction of chemistry and biotechnology indicate development trends with a huge innovative potential. After reading abstracts of some presentations, have you paid your attention to a distinguishing feature of some of these announcements? Or maybe such assessments could not be made before the Congress? Have the scientists and researchers from centres particularly active in biotechnology registered for the 7th Congress?

Biotechnology is an extremely broad discipline and research can be done regarding academic (biochemistry, genetic engineering or basic microbiology) or technical (biotechnological processes or industrial biotechnology) aspects. At the 7th Chemical Technology Congress, I am observing an activity in the field of processes using biomass as the new and renewable base of resources. In the days of depleting non-renewable resources, biological technologies can become an important alternative for traditional technologies. The use of biomass as an alternative resource, which is less concentrated and contains a burden in the form of organic matter, generates new problems and challenges for technological solutions. An example may be the development of a new technology for manufacturing fertilisers from renewable resources, in which keratin waste from animal production (e.g. feathers) is a source of nitrogen, bones are a source of phosphorus and ash from biomass combustion and micro-elements are as a source of potassium.

Numerous announcements and posters are taking on the subject related to the production of substances added to cosmetic products or food. The particular attention is paid to supercritical extraction. Professor, do you recognise it as the most prospective method for acquiring valuable compounds of e.g. plant origin? The activation of an industrial installation for supercritical extraction with CO₂ in the Fertilizer Research Institute in Puławy presents many new opportunities. This installation can produce many useful natural and active substances obtained not only from



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natural resources, but also from waste, including seaweeds and algae. Professor, what is your opinion on the chances for extensive use of this installation and broadening the range of useful and natural active substances?

In recent years, the consumers have been demanding the products available on the market to be safe for health and environment and at the same time, to have high biological activity. The process of isolating biologically active compounds from biomass requires using a wide range of isolating processes, including extraction with organic solvents. The presence of such solvents in products intended for plants, animals or people is undesirable for many reasons. On the other hand, the supercritical extraction with CO₂ creates an opportunity for eliminating solvents and obtaining the concentrate of biologically active compounds from the resource - biomass.

Another issue that is often raised in presentations prepared for the 7th Congress refers to the field of agrobiotechnology – production of fertilisers using microbiological methods. Are the advantages of using such fertilisers bigger than the ones gained while using the traditional products? Should we generally appreciate more the role of microorganisms in the development of ecological agriculture?

Agrobiotechnology, that is, the so-called green biotechnology makes it possible to produce many interesting and new products for agriculture. On the one hand, biomass is possible to be used as a carrier of nutritional substances for plants and animals (e.g. microelements), substances stimulating plant growth (e.g. plant hormones present in alga extracts); on the other, the activities of microorganisms can be applied as a specific “catalyst” for technological processes. A new concept of technology for phosphorous fertiliser production with the biotechnological method, in which bones, and not phosphorites, will be resources of phosphorus, can serve as an example. The chemical

structure of such a material makes it possible to apply milder process conditions than in case of a traditional method of wet-process phosphoric acid. In this method, organic acids or sulphuric acid, being the product of bacterial metabolism, are used as agent solubilising phosphorus. Additionally, the presence of microorganisms in the suspension fertiliser product gives it a character of specific bio-fertiliser and allows phosphorus to be further solubilised in soil, in the pool not available to plants.

Still with reference to agrobiotechnology - the research from recent years has been focused on improving feed for breeding animals by formulating an adequate set of microelements and biologically active substances. One of the proposals considers the production of mineral feed additives based on microalgal biomass... What advantages does such a solution offer to the consumers?

Micro-algae have unique properties of bonding microelement cations from a solution in the biosorption process. Such ions are bonded to functional groups present on cell surfaces. Therefore, microalgal biomass becomes a biological carrier of highly assimilated microelements in animals' diet. Such a solution is an alternative to mineral salts added to feed. Animal husbandry tests on laying hens and fattening pigs have confirmed pro-health effects of new formulations and good assimilation of microelements. Such a solution gives also a chance for biofortifying eggs and meat with microelements, that is, producing new generation food with increased density of microelements.

Why are algae recommended as having high potential for being applied in the production of mineral feed additives?

Algae live in water of high ionic strength, that is, in the environment of high concentration of metal ions. The specific structure of their cell wall causes that cell surfaces demonstrate unique properties of bonding cations from solutions. Among other things, polysaccharides such as alginate are involved in that process.

Ionic liquids, called also "green solvents" are an interesting subject that many researchers are concerned with. So, I have to refer to the paper of Professor Paryjczak, whose achievements will be awarded during the Jubilee Microsymposium. How do ionic liquids enter the green chemistry stream that is strongly propagated by Professor Paryjczak?

Professor Tadeusz Paryjczak is the propagator of the so-called "Green Chemistry". This subject area perfectly fits into the stream of Biotechnology. Due to the fact that biological processes occur under mild conditions (pH, temperature, lack of organic solvents), such technologies are more "green" than the traditional ones. Professor Paryjczak himself has been interested in this area for many years.

I met Professor when I was a student and had a scientific internship in Portugal. At that time, I was reporting the results of my research on a technology for utilising paper pulp in paper plants in Portugal. I was also extremely surprised when Professor appeared at the defence of my doctoral thesis. He specially arrived from Łódź to Wrocław. The thesis was on the application of algae in treating wastewater.

This speaks volumes for his deep scientific interests that are not only related to chemical technology, but also biotechnology.

Ionic liquids are said to leave the university laboratories and find a proper way to be applied in a wide industrial spectrum. Do you consider the scientific solutions presented during the debates of the Biotechnology and highly processed chemical Topic to have the application potential as well? How are the academic and industrial environments cooperating in the field of biotechnology?

In Poland, after the so-called system transformation, I can observe a kind of industrial scepticism towards the research works of Polish scientists. The national industry is afraid of taking a risk in implementing Polish technologies on an industrial scale. It is more reliable to buy ready and foreign licenses. This situation is reflected in a selection of research topics conducted in Polish academic centres. The academic projects are ambitious; however, they seldom refer to problems of national industrial plants. For years, the Ministry of Science and Higher Education has been organising competitions for financing projects of Polish scientists and their implementation into the national economy. However, the form of these projects imposes an obligation of financing a part of the investment on a business entity.

The research programme "Advanced processing of biomass into specialised chemical products", whose assumptions are currently being prepared by the National Centre for Research and Development, can be an opportunity for implementing Polish know-how in a field of biotechnology. If such a programme is set up, it will be a chance for Polish scientists to respond to the expectation of the national chemical industry.

In my opinion, the Chemical Technology Congress, whose tradition consists in meetings of the representatives of Polish chemical industry and scientists - technologists chemists, is a great opportunity for the commercialisation of research results. I hope that the 7th Chemical Technology Congress will result in establishing such co-operation and implementing Polish technologies.

We wish all the participants of the Biotechnology and highly processed chemicals Topic to have interesting debates and to exchange the knowledge that will result in developing innovative solutions and products. All Authors of this year's abstracts are welcome to publish their papers in CHEMIK monthly magazine. Professor, I would like to thank you for this interview.

An interview taken by *Anna Węgrzyn*
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