

Spring 2013

Biocatalysis and Green Chemistry

Agnieszka Poznanska
College of DuPage

Follow this and additional works at: <http://dc.cod.edu/essai>

Recommended Citation

Poznanska, Agnieszka (2013) "Biocatalysis and Green Chemistry," *ESSAI*: Vol. 11, Article 33.
Available at: <http://dc.cod.edu/essai/vol11/iss1/33>

This Selection is brought to you for free and open access by the College Publications at DigitalCommons@COD. It has been accepted for inclusion in ESSAI by an authorized administrator of DigitalCommons@COD. For more information, please contact koteles@cod.edu.

Biocatalysis and green chemistry

by Agnieszka Poznanska

(Chemistry 1105)

Consumers worldwide are developing preferences for “natural” or “organic” products and, because of that, the market for biotechnologically derived products is fast developing. People worldwide believe that organic or natural “green” products are better for their health in comparison to the nonorganic products, because they contain less or none of the potentially hazardous chemicals which are harmful for human health. This is also one of the most important features that in my opinion qualify a product as green. As well as the fact that green products should also contain fewer pesticides, antibiotics, artificial fertilizer, and genetically modified organisms. In general, it should be a safer product. As far as the process that could be considered green, it should reduce the use of energy and resources, as well as waste. It should eliminate costly treatments, and in general produce safer products that I mentioned before and improve competition in the marketplace. The philosophy is that it is better to be proactive in the prevention of waste than to react after its development. The principles and framework for this approach should include using benign substances instead of toxic ones, using fewer materials and natural resources whenever possible, using renewable materials, designing for energy efficiency, and planning for end of product life by using recyclable or biodegradable materials.

My choice as an example of a process that I think follows the principles of green chemistry is biocatalysis. Biocatalysis represent a useful tool in the field of biotechnological processes. It basically involves catalyzing a large number of stereo and regioselective chemical manipulations that are not suitably obtained by less selective classical synthetic procedures. The increasing ecological sensitivity supports the choice of environmentally friendly processes. Let's start from, “why do I think that biocatalysis is a “green” process?”

First of all biocatalysis helps to reduce the use and/or generation of hazardous compounds and it provides the use of renewable starting materials, as well as the employment of safer chemical transform materials and, because of that, biocatalytic processes are much “greener” than the corresponding classical chemical syntheses. The big down side of it is that it is still much more expensive. That is why sometimes this method is use in industrial production in combination with classical chemical synthesis. Despite the greater expense, biocatalysis is gaining popularity over chemical synthesis, which is a very good sign because a biocatalytic process redefines efficiency and environmental responsibility.

For now, this process is typically used in the pharmaceutical industry, which can afford processes that are more expensive. The biocatalytic method allows the manufacture of novel ingredients. Companies like Eastman have been using it to manufacture anti-aging ingredients. The company applied the 12 principles of green chemistry from the EPA to refine its operation. Now, Eastman expects to be commercializing products from this process. “We spent the past year and a half refining the process so that we could produce affordable green chemicals,” says Natale. “Green chemicals are in demand, but they come with a cost, a premium. The right thing to do is to be able to provide the most green materials that consumers can afford.”(Mason)

Increasing demand for natural products can have a negative impact on the environment. Concerned about biopiracy and species extinction, the industry is striving to source its raw material in the best way in order to protect the environment--using certified channels, fair trades and, now, plant cell cultures. As an example, I would like to use an Arch Personal Care Products, which launched its Regenistem line at the 2011 in-cosmetics show in Milan. The Regenistem process allows

the company to take only small quantities of plant cells from seeds or leaves, grow them in culture plates and then into bioreactors. The controlled environment allows the company to push the potential of the plants to the limit and manufacture very interesting ingredients.

"The process allows us to harvest rare or old plants and isolate unique actives or enhance the production of them, all while controlling the biomass in the laboratory," says Vince Gruber, PhD, director of research for Arch Personal Care Ingredients. The process minimizes requirements for harvest and cultivation, which wastes resources and opens the world of opportunity for the industry. The first in this line, 'Regenistem Rice', is an extract from a particular red rice species that is more than 1,000 years old and comes from a high elevation in Nepal." (Mason)

"Brand owners are interested in a unique label claim as well as in the active ingredients and what they can do for the skin. They want to take advantage of such biotechnological processes. 'Brands are driven by unique ideas,' explains Gruber. 'Plants that are unique or that grow in unique environments and offer benefits to the skin allow brands to build stories around them.'" (Mason)

"Driven by the already existing innovative companies that are looking to carve out a niche for all-natural products, the brand is trying to advertise this process. This process is renewable and it's not based on petroleum." (Mason) The name of it is ReGeniStem™ Red Rice and this is what the exact description of this product that you can find on the company website says:

"ReGeniStem™ Red Rice is a botanically sourced product that is made via a sustainable process of cultivating state-of-the-art plant cell cultures in bioreactors, which reduces the residual biomass waste and environmental impact. ReGeniStem™ Red Rice allows for increased secondary metabolite production through the use of natural plant elicitors, restores cellular epigenetic patterns of old cells to that of young cells and reverses the age-related increase in DNA methylation, leading to an increase in collagen production."

The cost for those facial skin products is a little higher but I personally am willing to pay that price because I think it is worth the extra cost. I think that the fact that I'm using organic, chemical-free products that are safer for me and my skin is worth the higher price. You cannot put a price tag on good health. What comes to my mind is the expression "to feel good in your own skin" and how important this is to our better well-being (especially as women).

References

Title: "Opportunities and advantages in green: finding innovative approaches to make the same products with fewer resources is best for consumers, companies and the environment".
Global Cosmetic Industry Jan- Feb 2011
Author: Mason Sara 46 Academic OneFile, web, 27 Nov 2012