ECONOMIC AND TECHNOLOGICAL IMPORTANCE OF CATALYSTS IN NIGERIA

Ajala, A. A.
Standard Organization of Nigeria (SON)
Osogbo, Osun State, Nigeria
E-mail: mailchemistyomi@yahoo.com

ABSTRACT

Catalysts are pivotal in the economic and technological advancement of a nation. Most nations of the world can trace their developments in virtually all sectors of their economy to the use of catalysts. They are the fundamental drivers for the viability of most industries. This study focused majorly on the economic and technological importance of catalysts. The chemical and biological catalysts (enzymes) were properly analyzed, and their economic importance was brought to light in this work. The study disclosed that chemical catalysts are used in the manufacture of almost all chemical products. Hence, International Labour Organisations, United Nations and other stakeholders should enforce strict safety regulations on industries producing catalysts so that the ecological and health risk involved in its production can be reduced to the barest minimum.
Keywords: *Catalysts, Enzymes, Production, Chemicals, Technology*

INTRODUCTION

Catalysts are basic drivers and pivots in the economic viability of American chemical industries (Ojo, 2007). The use of catalysts and particularly their biological version (enzymes) has recently been the subject of increased debate in research, technology and environmental policy. According to Ojo (2007), chemical catalysts enjoy a good reputation, particularly as aids in reducing automotive emissions. Enzyme technology enjoys the favorable aura of biological process and natural manufacturing processes. Both biological and chemical catalysts are regarded as pioneering key technologies for sustainable future, as they make possible the manufacture of innovative products (Pharmaceutical materials etc) in addition to opening up other important fields of application in chemical synthesis. Examples of these fields of application are environmental protection and energy transformation. These fields of application have great potential for breaking down the boundaries between individual disciplines, and between fundamental and applied research. In the year 1993 the world production of industrial catalysts had a value of 12 billion, with the USA accounting for 4 billion, Germany and Japan for 1.8 billion each (Ojo, 2007; SPCET, 1996).

ECONOMIC AND TECHNOLOGICAL IMPORTANCE OF CHEMICAL CATALYST

Certain chemical and biological processes will delay more than necessary thus exhibiting significant negative effects on the intending beneficiaries if not gingered

by some forces. Catalysts, generally help to speed up the rate of chemical reaction, but do not in itself transform in the course of such reaction. They are particularly concerned with chemical reactions only. Finar (2003) defines catalyst as the substance that has the ability to alter the rate of chemical reaction (either acceleration or deceleration without themselves changing chemically during the course of the reaction. Chemical catalysts are used in the manufacture of almost all chemical products. Process innovations in the chemical industry in a particular area based essentially on developing catalysts. 20% of catalysts are used in oil refining in the chemical industry and 40% in the downstream emission control, of which 95% in turn is for automotive catalytics (SPCET, 1996).

Automotive catalytic converters in particular showed dynamic growth in the nineties as a result of stricter emission levels and will continue to generate expected growth rates of up to 5%. In the USA, chemical industry is the segment of the industry which processes over 7000 worth of some products from chemicals, for example plastic products showed a net trade surplus in the United States through the use of catalyst. For Chemical Industries in the United States, chemicals remain the leading US export. 10% of total US export worth (US$61.4billion), modestly exceeding grains and agricultural goods (Adeyemi and Ologunde, 2004; SPCET, 1996).

Fluidized Catalytic Cracking (FCC) in fuel production increased the octane units per barrel of feed from 4900 to 6000 per feed. Varieties of products are manufactured using catalytic routes. For example industrial intermediates (Sulfuric acid), pharmaceuticals (penicillin), specialty chemicals (indigo) and food sweeteners from corn (fructose) (SPCET, 1996). Chemical industry (especially in the US) produces a favorable trade balance because the US exports more than twice its imports in chemicals (SPCET, 1996). Industries that produce catalyst and others that make use of catalyst produce on a large scale and as such they employ more workers. With this leverage through catalysis. It is no wonder that catalysis based chemical synthesis now accounts for an estimated 60% of today's chemical production and 90% of current processes (SPCET, 1996).

ENZYMES: USES AND TECHNOLOGICAL TRENDS

The substance responsible for biological reactions are referred to as enzymes which in the view of Adeyemi and Olagunde (2004) are organic substances that have the ability to influence and (most of the time) accelerates the rate of chemical reactions without themselves changing chemically in the course of the reaction. The main applications and areas for the use of enzymes are food and drink production (starch industry, dairy products, alcoholic beverages, juices and products for the baking and confectionery industries, detergents, and cleaning agents, textile, leather and feed processing, manufacturing laboratory grade chemicals, medical diagnostic and therapeutic processes (SPCET, 1996). The most important technological areas where enzymes are utilized are in analysis and diagnostics which has molded the life sciences generally. Enzymes also play an essential role in the use of renewable raw materials,

where they break down materials and make them available for further processing. In the production of fine chemicals, enzymes are only exceptionally used for products on the multi-ton scale, even though growing demand is expected because of the need for enantiomer-pure synthesis. However, there is a wide range of barriers to greater use of enzymes technology in the chemical industry, ranging from the excessive specificity and sensitivity of enzymes to problems of process conversion to issues of plant depreciation or the occupational bias of decision-makers. As with conventional chemical catalysts, interdisciplinary co-operation is required.

HEALTH IMPACT AND ECOLOGICAL RISK OF THE USE OF CATALYST

Industrial production of enzymes is done with few exceptions through the use of micro-organisms cultured in closed system. Risks to employees can arise primarily from the micro-organisms or their components and by-products, the enzymes themselves and from culture medium components and production-related hazardous substances. Most enzymes of which come under the caption "GRAS" (Generally Recognized As Safe) (SPCET, 1996). Though conventional enzyme production and use involve a large number of microbes which are much more dubious in toxicological terms.

A further consideration is that there are far more employees in companies using enzymes than in enzyme production companies. Monitoring proposed safety measures, thorough training for employees' involved and constant monitoring compliance with regulations is all needed. Chemical catalysts are used primarily in closed industrial production systems, so that toxicological problems with compounds that often contain heavy metals arise mostly in production, commercial use and recycling (SPCET, 1996).

An improvement in safety is expected from increased immobilization of catalysts on substrates, which can also facilitate recycling of compounds which are sometimes very expensive. The only "consume product" is the automotive platinum catalytic converter. Platinum compounds are toxic and particularly allergenic. Despite years of research, knowledge about the bioavailability of platinum, which is found in increased concentrations at the side of road, is still very small and the current state of knowledge does not permit a toxicological assessment of the increasing pollution (SPCET, 1996).

END-OF-PIPE ENVIRONMENTAL PROTECTION AND INTEGRATED ENVIRONMENTAL TECHNOLOGIES

End-of-pipe and add-on technologies are the examples of the most important use of catalysts in environmental protection in quantitative terms. End-of-pipe catalysts are used for converting emissions (in industry, power stations and vehicles) which are gaseous in nature (SPCET, 1996). This involves a range of add-on or recycling technologies which convert pollutants into useful product (SPCET, 1996). Intact

micro-organism from waste, sewage and exhaust air treatment are inevitable, unlike isolated enzymes (SPCET, 1996). Catalysts reduce the activation energy required for a chemical reaction and increase desired product yield. By so doing it replaces or improves the conventional processes using catalysts or enzymes that will spare raw materials (the starting materials) and energy, while at the same time reducing waste (SPCET, 1996). Measures of integrated environmental protection like this may have a relatively insignificant role in economic terms but their future relevance is a general pre-requisite for a sustainable industrial economy (SPCET, 1996). An example of consumer product in which environment protection enzymes are used is the detergent sector. This is the most crucial non-food biocatalyst. Textile, leather and paper manufacture are other application areas in which enzymatic processes can contribute to avoiding the use of chemicals and saving water and energy. The use of enzymes in environmental analysis and monitoring, where biosensors have long proved an essential air is still being developed.

CONCLUSION

The importance of catalysts to the economic development of a nation cannot be over-emphasized. Most advanced countries have an area still using catalyst as a veritable tool for developing various sectors of their economy. Knowing that the importance of catalyst cannot be under-estimated in the development of any nation. Developing and under-developed countries area also enjoined to follow suit. Instead of importing the finished products which were prepared through the use of this catalyst. They should also be manufacturers of same.

However, international labor organization (ILO), United Nations (UN) and other stakeholders should enforce strict safety regulations on industries producing catalysts and enzymes so that the ecological and health risk involved in its production can be reduced to the barest minimum. If most third world countries which are majorly found in Africa can embrace mass production of catalyst and enzymes, in no time, they will be at almost the same level with the developed world.

REFERENCES

Adeyemi A. I. and **Ologunde M. O.** (2004). Explanatory Notes in Food Biochemistry. Lagos: Bolabay Publications, Nigeria

Finar I. L. (2003). Organic Chemistry Volume 1 (Sixth Edition). Singapore: Pearson Education Pte. Ltd.

Ojo I. A. O. (2007). Lecture Notes on Catalysis. Unpublished. Ladoke Akintola University of Technology, Ogbomoso, Nigeria.

Status and Prospects of Catalysts and Enzymes Technology (SPCET) (1996). Summary of TAB Working Report No. 46 in www.tab.fzk.de.