# ADDICTED TO CHALLENGE: MAN, MICROBES AND THE QUEST FOR ENERGY

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Microbiology is the study of the tiniest form of living things found on earth, generally with sizes in the micrometer range. Microbial fermentation enlists many biochemical pathways which allow for re-arrangement of atoms of nutrient components through release and /or uptake of electrons during microbial metabolism. During microbial growth in a bioreactor, physiological manipulations of a series of metabolic energy-conserving or energy-demanding fermentative reactions results in the formation of uniquely different value-added products referred to as primary or secondary metabolites such as enzymes, antibiotics, organic acids, wines, pigments, pesticides, anti-tumour agents, toxins and plant growth promoters. The production, quality control and yield amplification of these metabolites to spontaneously generate maximal amount of energy in form of ATP are the key aspects of Industrial Microbiology. In efforts aimed at adding value to man, wastes from agricultural and industrial operations were utilized as electron donors and receivers in fermentation processes employing a knowledge of Microbial Physiology, Biochemistry and Biotechnology. These microbial manipulations were employed in the biotransformation of polymeric agrowastes through microbial depolymerisation to create value added products.

Fermentation of poultry litter, palm kernel meal, husks of rice and palm fruit through microbial whole cell and enzyme supplementation increased the Crude protein, Nitrogen free extract, calcium, phosphorus, biomass and amino acid content of the substrates. When employed in poultry diet, the value-added fermentative products elicited increased bird weight, percentage egg yolk, shell weight feed conversion efficiency, meat-bone ratio and metabolisable energy compared to normal commercial poultry rations. Enzymatic saccharification and fermentation of lignocellulosic biomass-based wastes, such as cocoa pod husk enhanced bioethanol yield. Biomass cultivation of high lipid-producing freshwater microalgae and trans-esterification of its lipid supported the production of a globally-acceptable environmentally-friendly biodiesel. Genetically transformed electrogenic *Pseudomonas aeruginosa*-A4 generated bioelectricity which successfully powered L.E.D. bulbs and a digital clock thus contributing to the renewable energy options in a bid to preserve the environment and reduce costs. Weaning foods with acceptable Reconstitution Index, Water-holding Capacity, Bulk density and Gross Energy was developed using starter-fermented and legume-fortified cereal food blends thus preventing malnutrition in the African child. Unique, broad spectrum antimicrobial bioactive metabolites from actinomycetes and lactic acid bacteria bacteriocins successfully combated resistant pathogenic microorganisms. The use of cellulolytic, hemicellulolytic, lignolytic and xylanolytic enzymes to release the “locked-up” materials in Nigerian softwood generated biopulped materials with universally-acceptable pulp characteristics. Cultivation of microorganisms on the wood substrates generated industrially-useful dye-decolourising thermostable microbial laccases, lignin peroxidases and manganese peroxidases. The controlled fermentation of various substrates generated organoleptically and nutrient-optimised infant weaning food, high gravity sorghum beer, cassava-based foods and reduced flatulence-causing oligosaccharides in soybeans.

Cereal substitution with starter-degraded agrowastes is recommended in animal management while whole cell and enzyme-mediated industrial processes for biopulping, biobleaching and de-lignification is advised in agrowaste management for production of value-added materials. The development and implementation of Federal Government policies on improved biotechnological research in Nigeria is highly desirable.