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NEWS LETTER

ON

TRADITIONAL KNOWLEDGE AND PROSPECTS OF BIOTECHNOLOGICAL IMPROVEMENT

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EDITORIAL

Traditional knowledge (TK) is interchangeably indigenous knowledge (IK) is difficult to define as they may be owned by the community or by the family and they may not be ancient. It is used to describe any information, knowledge, innovation, or practices of the indigenous local communities that is of relevance in ensuring the conservation and sustainable use of biodiversity. Biotechnology, either traditional or classical, may assist the innovation and economic development of local community through the innovation and value-added activities on the traditional knowledge. There is a big potential for developing countries to develop biotechnology by utilising traditional knowledge based inventions to enhance their economic competitiveness and their share of global market of biotechnology. Biotechnology can assist the innovation and economic development of traditional knowledge holders. In fact some of the traditional knowledge is actually part of biotechnology and this shows that biotechnology is not necessarily a modern matter. Biotechnology related traditional knowledge can be further developed into high end products.

(Ashis Kumar Panigrahi)

IN THIS ISSUE:

Traditional knowledge(TK) is the knowledge adopted by some indigenous community for years using the biological resources (mainly plant) for their livelihood in sustainable manner. In recent years there are increasing importance of traditional knowledge both in the economy as well as in biodiversity conservation, has attracted by multinational companies and research organizations for commercial exploit without proper acknowledgement and compensation to the indigenous group. Biopiracy is the appropriation of another's knowledge of use of biological resources. A number of cases of biopiracy issue have been reported in India which is necessitate for protection of TK from such misappropriation in this biodiversity rich country through plan and adopt different protective measures.

TRADITIONAL KNOWLEDGE AND PROSPECTS OF BIOTECHNOLOGICAL IMPROVEMENT

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Introduction

The term 'biotechnology' was used before the twentieth century for conventional activities such as making dairy products such as cheese and curd, as well as bread, wine, beer, etc. The process of fermentation for the preparation and manufacturing of products such as alcohol, beer, wine, dairy products, various types of organic acids such as vinegar, citric acid, amino acids, and vitamins can be called classical biotechnology or traditional biotechnology. Fermentation is the process by which living organisms such as yeast or bacteria are employed to produce useful compounds or products. Modern biotechnology is similar to classical biotechnology in utilizing living organisms. The introduction of a large number of new techniques has changed the look of classical biotechnology forever. Despite great advances in agricultural productivity and economic well-being in much of the world over the past 50 years, food insecurity and poverty continue to be serious issues in many regions (FAO, 2008). Moreover, in 2008, the planet entered a era of deepening uncertainty and economic downturn that impacted significantly on the future security of food production and distribution systems (Nellemann et al., 2009). These modern techniques, applied mainly to cells and molecules, make it possible to take advantage of the biological process in a very precise way. For example, genetic engineering has allowed us to transfer the property of a single gene from one organism to another. But before going into the details of biotechnology and the techniques that make it possible, let us first define biotechnology.

Defining Biotechnology

One of the challenges in discussing biotechnology is the lack of a steady definition of the term itself. In this text, the following definition from the Convention on Biological Diversity (CBD) is used: "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use". It covers both classical as well as modern biotechnology. Biotechnology can also be defined as "the use of living organisms, cells or cellular components for the production of compounds or precise genetic improvement of living things for the benefit of man".

Historical Perspectives

Biotechnology as a science is very new (about 200 years old) but as a technology it is very old. The word biotechnology, first used in 1917, refers to a large-scale fermentation method for the manufacture of various types of industrial chemicals. But the roots of biotechnology can be traced back to pre-historical civilizations, such as Egyptian and Indus valley civilizations, when man learned to practice agriculture and animal domestication (Nair 2007).

i. Biotechnology in Prehistoric Times:

Primitive man became domesticated enough to breed plants and animals; gather and process herbs for medicine; make bread, wine and beer and create many fermented food products including yogurt, cheese, and various soy products; create septic systems to deal with digestive and excretory waste products; and to create vaccines to immunize themselves against diseases. Ancient Indus people, for example, prepared and used various types of fermented foods, beverages, and medicines. The ancient Egyptians and Sumerians used yeast to brew wine and to bake bread as early as 4000 BC. People in Mesopotamia used bacteria to convert wine into vinegar. The Greeks used crop rotation to maximize crop yield and also practiced various methods of food preservation such as drying, smoking, curing, salting, etc.

ii. Utilization of Genetic Resources:

The ancient people were also aware of the role of natural genetic resources such as plants in the economic growth of a land. The rulers at those times used to send plant-collectors to gather prized exotic species of plants that produced valuable spices and medicines. These early 'gene banks' helped the colonial powers to establish agricultural monocultures around the globe.

iii. Microorganisms and Fermentation:

Although baking bread, brewing beer, and making cheese has been going on for centuries, the scientific study of these biochemical processes is less than 200 years old. Clues to understanding fermentation emerged in the seventeenth century when Dutch experimentalist Anton Van Leeuwenhoek discovered microorganisms using his microscope. Two centuries later, in 1857, a French scientist Louis Pasteur published his first report on lactic acid formation from sugar by fermentation. He proved that fermentation is the consequence of anaerobic life and identified three types of fermentation: a) Fermentation, which generates gas; b) Fermentation that results in alcohol; and c) Fermentation, which results in acids.

At the end of the nineteenth century, Eduard Buchner observed the formation of ethanol and carbon dioxide when cell-free extract of yeast was added to an aqueous solution of sugars. The fermentation process was modified in Germany during World War I to produce glycerine for making the explosive nitroglycerine. Sir Alexander Fleming's discovery of penicillin, the first antibiotic, proved highly successful in treating wounded soldiers.

iv. The Genesis of Genetics:

In 1906, Gregor John Mendel announced the findings of his experiments as the 'laws of genetics'. He predicted the occurrence of 'units of heredity'—later on called genes—which did not alter their characteristics from generation to generation but only recombined. The science of genetics derived from the term 'genesis'. By the 1940s, genetics had transformed the agriculture sector, which led to the Green Revolution in the 1960s.

v. DNA and Genetic Engineering:

The Beginning of Modern Biotechnology: The science of genetics was transformed by the discovery of DNA and RNA, which carries the hereditary information in the cells. The chemical DNA had already been exposed in 1869 by Friederich Miescher but two scientists, Francis Crick and James Watson along with Rosalind Franklin, in 1953, discovered that the DNA structure was a double helix: two strands twisted around each other like a spiral staircase with bars across like rings. Marshall Nirenberg and H. Gobind Khorana discovered the genetic code in 1961. The creation of monoclonal antibodies for diagnostics was carried out in 1982, and the first recombinant human therapeutic protein, insulin (humulin), was produced in 1982. In 1976, the U.S. company

Genentech became the first biotech company to develop technologies to rearrange DNA. Commercial uses of recombinant-DNA-assisted biotechnology include the development of interferon, insulin, and a number of genetically-modified crop plants such as the high-solids-processing tomato that has 20% less water. Transgenic animals have been shaped such as onco-mouse designed to develop cancer.

Uses of Biomaterials in Biotechnology

Biotechnology of biomaterials is use of metals and chemicals as Biomaterials and bio-nano-composites materials like Hydroxyapatite, Zinconia, Alumina (Yousefpour et al., 2011) used in the dental implants, in turn the production of Hydroxyapatite from garden snail shell (*Helix aspersa*) is also an amazing application of biotechnology (Singh and Purohit 2011).

Application of Biotechnology in Genetic Engineering

Genetic engineering is the technology of transferring individual genes between organisms or modifying the genes in an organism. These GM crops or GMOs are used to produce biotech-derived foods.

Application of Biotechnology in Bioprocessing Techniques

One of the important methodologies in the Bioprocessing techniques is Response Surface Methodology (RSM) it has many applications in the modern Processing units. It can make easier optimization of Production of various Proteins like Mycoproteins, Enzymes and other compounds like pigments or more limpidly Flavonoids (Sai et al., 2011).

Biotechnological Importance in Biosensors and Bioelectronics

Cadmium can cause bone demineralization and affect both the kidney directly. Cadmium may come in the body through food, water, air or absorption through the skin. A novel absorption-transmission based, miniaturized fiber optic biosensor has been discovered for the detection of cadmium in milk (Sai et al., 2011).

Conclusion

All the techniques cannot easily be implemented in developing countries, mainly due to the limited resources. In these case, local solutions must be sought using local materials and innovations. As the developing countries become more industrialized, they should from the mistakes made by those countries with long industrialization history. The knowledge of biotechnology should not be used to introduce or manipulate genes across the species or phyla in order to increase productivity.

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Fig. Indian Spices with medicinal value

FLORAL CRAFT - TRANSFORMATION OF AESTHETIC VALUES IN BUSINESS

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Introduction

Dried flowers and other plant parts is a Rs. 100 crore industry in India and such dry decorative materials are globally accepted as natural, eco-friendly, long lasting and inexpensive. India is one of the major exporters of dried flowers to the tune of 5% world trade in dry flowers. This industry shows a growth rate of 15% annually. Forest in India is enriched with high floral diversity. Drying and preserving flowers and plant materials is a form of artistic expression that was very popular during the Victorian age and has once again gained popularity. Dried or Dehydrated Flowers or Plant part or Botanicals (Roots, leaves, Stem, Bark or Whole plant) can be used for ornamental purposes. The knowledge of utilizing the forest resources are quite popular among the forest folk. Women have an intimate and longtime association with the forest for the purpose of collection of wood as fuel in order to live their livelihood. They also have a wide knowledge and sense of beauty of the wild flowers. Easy availability of products from forests, possibility of women manpower available for labour intensive craft making and availability of wide range of products throughout the year are the reasons for development of dry flower industry in India. Since flowers and foliage consists of more water, dehydration is necessary for getting dry flowers. Methods used for removing water from plant parts are air-drying, sun drying, oven drying, embedding (sand, borax, silica gel and combination of these materials), glycerin (Glycerinating), microwave oven drying, freeze-drying and press drying Dehydrated plant parts may be arranged aesthetically and covered with plastic or transparent glass to protect them from atmospheric humidity, wind and dust. Suitable packing methods are needed for their storage, transport and marketing. In India nearly 60% of the raw materials are sourced from natural forests and plains, only 40% of the flowers are cultivated fordrying.

Techniques for Drying

The drying of flowers and floral parts include several processes such as-

A. Air Drying: Hanging bouquets upside down is the most traditional technique for drying of flowers. The flowers are collected in a bunch, and the stems are tied with a rubber band. Hang the total arrangement upside down in a well-ventilated room protecting it from direct sunlight like, from kitchen rafters or in an empty closet. Slowly the petals shrink and change color, and within two-three weeks you'll have beautiful dried flowers in vintage hues. These dried bouquets can be used in making ofcenterpieces.

B. Press drying: The flowers are cut right before they hit their peak bloom in the morning after the dew has evaporated. Line the flowers on newspaper, plain, white paper, tissues or blotting paper (any paper that can absorb moisture) and place another sheet on top. These papers are piled in stacks and placed in the wooden plant press at room temperature for 7-8 days. Care should be taken to change the sheets after every two days. Pressing is ideal for drying flowers that you want to place in a picture frame, between glass or in a piece of jewelry. They are also used for making of greetings card, tablemats, coasters, bookmarks and wallhangings.

C. Embedding: If you don't want to wait weeks for your flowers to dry, this method is the best way. The flowers (without the stems) are placed in a microwave-safe container covering the flowers with silica gel, silica sand mixture or an equal mix of borax and cornmeal. The container should be left uncovered while in microwave for 3-5 minutes at 80-100 ºC depending on the type of material. Finally, the flowers are left undisturbed in the mixture for 3– 24hrs as setting time. In this process the total

morphology and colour of the flowers remain intact. These dried materials are used for making various types of floral arrangements and three-dimensional show pieces.

D. Glycerine Drying: Plant material preserved with glycerin has rich color and texture. Glycerine treatment is usually used for foliage, but baby's breath (*Gypsophila muralis*) and the flower heads on grasses can also be preserved with glycerine. The transformation is amazing to watch as deep green leaves take on shades of orange, yellow, red and bronze at different rates, resulting in a multicolor display. The end result is attractive plant material, sometimes with several colors on a single plant and durable stems and flowers that last for years. Glycerin and boiling water is mixed in the ratio 1:1, 1:2,1:3 for the purpose of drying. The ratio opted depends on the nature of plant material. The materials are dried within2-3 weeks. As glycerin replaces the moisture in the plant's veins, the flowers and leaves become fleshy and supple rather than brittle like traditionally dried plants. Late summer is the best time to cut flowers for glycerin treatment if we want brilliant leaf col- or on the stems.

E. Freeze Drying: Freeze drying flowers uses a process called lyophilization to lower the temperature of the flowers to below freezing, and then a high-pressure vacuum is applied to extract the water in the form of vapour. The vapour collects on a condensing surface outside the chamber, turns back to ice and is removed. Finally, a gradual temperature rise extracts all remaining bound moisture from the flowers. This process retains the original shape and structure and preserves the flowers.

Storage of Dried Flowers

Dried flowers obtained from press drying are generally stored in sealed plastic bags and those from embed- ding are stored in dessicators with fused calcium chloride. Dried material is attacked by Fungus and other insects. If such specimen is noticed, it is better to destroy the infected materials. Tightly sealed containers prevent invasion. Naphthalene flakes may repel insects or some general insecticides may help control them, but once an area is infested, complete eradication is difficult. Cleanliness and persistence are the best means of remedying thesituation.

Don't consider dried flowers as everlasting. Preferably, dried flowers should be replaced yearly, but with good care they often last longer. Even the best dried flowers gradually fade and should be discarded when they no longer produce the desired effect. Flowers that tend to fade may be lightly tinted with aerosol paints or dyes for more durable color. With care, the natural look is preserved.

Preservation

The best way to preserve dried flower and floral parts is to coat the material with molten wax of melting point 55-60ºC. This coating not only preserves the material but also gives it a shiny textural look which isin high demand in case of floral arrangements.

Suitability of Technique and Utilization

Press dried materials are used for preparation of diversified value-added products. Dry flowers with original colour and shape, developed through embedding, can be utilized for preparation of three-dimensional arrangements. There is no limit of product range. However, some have already been designed like : bou-quets, wall hanging, artistic greeting cards, get well cards, wall plates, calendar, pictures, flower baskets, refrigerator magnets, mirror decoration, hats, embedding in gold/silver or resin to use as jewelry, land- scape, table mats, coasters, three dimensional arrangements of flowers for interior decoration etc. Floral album may be prepared for identification of plants for taxonomic studies. Dehydrated flowers may be used as botanical specimens for demonstration and for teaching students. A cottage scale industry based on de- hydrated floral craft can come up for self-employment of youths

and for earning money to the house wives as well as rural women by providing them with a part time creative occupation. It takes little practice but the results are rewarding. The Department of Science and technology through the Department of Molecu- lar Biology and Biotechnology, University of Kalyani, have initiated to impart training based on this tech- nology. Present technique has the ability to develop new markets through diversification of products. There is also a need to create sufficient awareness about the potentiality of this technology. Proper education/ training to farmers/ florists, rural women, house wives, unemployed youths etc is necessary about the dehydration technology, true novelty of the products utilizing neglected and underutilized plant species and can serve as a source of income for leading theirlivelihood.

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Photographs



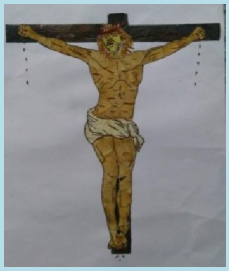
Press dried Material



Oven Dried Material



Table mat | Coaster | Bookmark



Potraits and Landscapes



Flower Arrangements

CASE STUDIES ON BIO-PIRACY OF TRADITIONAL KNOWLEDGE IN INDIA

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Bio Piracy of Traditional Knowledge

When a third party use traditional knowledge without permission, or exploits the cultures they're drawing from called biopiracy. It is the commercialisation of TK of rural and indigenous people. Numerous cases of biopiracy have highlighted this issue and have increased demands for protection of TK from such misappropriation, causing many biodiversity rich countries to design and adopt different protective regimes.

Of late, the major issue involving biopiracy is the exploitation of patent biological resources or knowledge of farmers and traditional communities and indigenous tribes by many organizations and multinational companies. Due to increasing the demand from consumers in industrialized countries for herbal products, the pharmaceutical companies to seek possible leads in indigenous systems of medicine and the information present with the traditional healers of indigenous and local communities.

Source: http://djayurvedacollege.org/

Fig. Traditional medicins

Some Indian Cases Study

1. Neem (*Azadirachta indica*)

Neem tree is also called as the 'curer of all ailments' in Sanskrit, the Neem tree is used for medicinal, agricultural, pesticidal, contraceptive, cosmetic and dental applications. The tree has been referred to 'blessed tree' by both the Hindu and Muslim population in India. There are approximately 14 million Neem trees (*Azadirachta indica*) in India. Products of Neem are cheap and also easy to get. It is a tropical evergreen, which mainly grown in arid regions of India and Burma and Southwest Asia and West Africa. It is estimated that it live up to 200 years. The Neem tree helps as a cure for poor conditions of soil, plants and livestock. The different part of the trees(i.e. leaves, bark, flowers, seeds and fruit pulp) are used for treatment a wide range of diseases like, leprosy, diabetes, ulcers, skin disorders and constipation. The plant extracts has also been used to make spermicides and pesticides. Neem cake (residue after oil extraction) is fed to livestock and poultry, while its leaves increase soil fertility. The Neem tree available in all seasons.

The biopiracy dispute has been involved between India and United States (USA) on a number of products of Indian origin like, Neem, Turmeric, Basmati etc.An US based agri-chemical company *W.R.Grace* in Florida, developed a technology to extract the active ingredient from the neem seed in a stable solution and patented the stabilization process and the ingredient with the United States Patent and Trademark Office (USPTO). He then obtained a European patent in 1994 jointly with the United States Department of Agriculture (USDA) on the manufacturing process of the neem tree seed oil as a fungicide. While the neem tree has been used in India for over 2000years for various purposes such as pesticides, germicides and toothbrushes. W.R. Grace had been suing Indian companies for

producing the emulsion because they had a patent on the process. The dispute was over the rights of companies to conduct research and development by using patents against the interest of the people who live at the source of the tree. These patents meant that India, despite its ownership of the neem tree and having used the medicinal plant for centuries, had no legal rights to develop the plant for medicinal or curative purposes (Frederick, 2000). It was considered to be both the intellectual as well as the biological piracy.

Source: *https://www.wikilawn.com/trees/azadirachta-indica-the-neem-tree/*

Fig. Neem tree with flower

2. Basmati Rice (*Oryza sativa* Linn.)

Rice is a cereal grain, it is the most widely consumed staple food for a major part of the world's human population, especially in Asia. Basmati is a long-grained, aromatic variety of rice indigenous to the Indian subcontinent. It is, famous for its fragrance and delicate flavour. It has been cultivated in the Indian subcontinent for hundreds of years. It was developed by Indian farmers over hundreds of years. Due to its fragrant taste, Basmati became a controversial 'issue' after *RiceTec*, a Texas-based company, in 1997, patented some types of rice they developed as "American basmati". The Texan company *RiceTec* obtained a patent for a cross-breed with American long-grain rice. *RiceTec* was granted the patent on the basis of aroma, elongation of the grain on cooking and chalkiness.

One of the documents relied upon by *RiceTec* as evidence in support of the registration of the said mark was the US Patent 5,663,484 granted by US Patent Office to *RiceTec* on September 2, 1997 and that is how this patent became an issue for contest. *RiceTec* Inc, had been trying to enter the international Basmati market with brands like "Kasmati" and "Texmati". Ultimately, the company claimed to have developed a new strain of aromatic rice by interbreeding basmati with another variety. They call the allegedly new variety as Texmati or American Basmati.

CFTRI (Central Food Technological Research Institute) scientists evaluated the various grain characteristics and accordingly the claims 15-17 were attacked on the basis of the declarations submitted by CFTRI scientists on grain characteristics. Eventually, a request for re-examination of this patent was filed on April 28, 2000.

Fig. Basmati rice plant and seed

3. Turmeric (*Curcuma longa* Linn.)

Turmeric plant is a flowering plant with a rhizomatic root structure that is thought to be indigenous to South and South-East Asia. Its dry rhizome powdered and used both as a cooking spice and in traditional medical systems. The use of turmeric in Ayurveda is to prevent inflammation and infection. The rhizomes of turmeric are used as a spice for flavouring Indian cooking. It also has properties that make it an effective ingredient in medicines, cosmetics and dyes. As a medicine, it has been traditionally used for centuries to heal wounds and rashes. In December 1993, a patent was filed by the University of Mississippi Medical Center, Mississippi. Applicants received US patent 5,401,504 for the use of turmeric powder as a wound-healing agent. Indian

Government objected to the patent. The turmeric patent failed to satisfy the criteria of novelty in view of the cited turmeric's qualities documented in ancient medical textbooks. The CSIR, India, New Delhi filed a re-examination case with the US PTO challenging the patent on the grounds of existing of prior art. CSIR argued that turmeric has been used for thousands of years for healing wounds and rashes and therefore its medicinal use was not a novel invention. Their claim was supported by documentary evidence of traditional knowledge, including ancient Sanskrit text and a paper published in 1953 in the Journal of the Indian Medical Association. Despite an appeal by the patent holders, the US PTO upheld the CSIR objections and cancelled the patent. The turmeric case was a landmark judgment case as it was for the first time that a patent based on the traditional knowledge of a developing country was successfully challenged. The US Patent office revoked this patent in 1997, after ascertaining that there was no novelty; the findings by innovators having been known in India for centuries (Mashelkar, 2002).

Source: *https://www.cosmacon.de/en/turmeric-extract/*

Fig: Turmeric rhizome & powder

Conclusion

Traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities often relating to their surrounding natural environment like agriculture knowledge, scientific knowledge, technical knowledge, ecological knowledge, medicinal knowledge. TK is a living body of knowledge that is developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity. Indigenous people posses important traditional knowledge that have allowed them to sustainably live and make use of biological and genetic diversity within their natural environment for generations. The TK is facing a problem of bio-piracy. The conservation of species, habitat, and biodiversity are essential to the continued survival of indigenous and rural people. Successful documentation of indigenous TK will protect the IP system.

TRIPs stands for Trade-Related Aspects of Intellectual Property Rights established by the WTO in Marrakesh, Morocco on 15 April 1994 and the agreements signed at the Uruguay Round of GATT negotiations in 1995. The Convention on Biological Diversity (**CBD**) concluded on 5 June 1992, was the result of discussions at the Rio de Janeiro 1992 UN Conference on Environment and Development towards a strategy for sustainable development. The CBD, administered by UNEP, establishes principles for the protection of the environment while ensuring ongoing economic development, emphasizing conservation of biodiversity, sustainable use, and fair and equitable benefit sharing of that use of genetic resources. On the other hand, developing countries according to CBD have to protect and conserve all kinds of biological resources and the environment of both human and animal beings. Thus, it is true that the TRIPS Agreement encourages countries to give monopoly over life forms through patent system. Yet as an international commitment, the CBD is as legally binding and authoritative as TRIPs.

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FORTHCOMING EVENTS		
Events	**Date**	**Place & Correspondence**
637th International Conference on Environmental Science and Development (ICESD)	15-16th July, 2019	New Delhi, India http://www.academicsworld.org/Conference2019/India/2/ICESD
International Conference on Environment, Energy and Biotechnology (ICEEB 2019)	2nd - 5th July, 2019	Okinawa, Japan http://www.iceeb.org
5th International Conference on GIS and Remote Sensing	16-17th September, 2019	https://gis-remotesensing.environmentalconferences.org/ Rome, Italy
3rd International Conference on Nanomaterials and Biomaterials (ICNB 2019)	Dec 2, 2019 - Dec 4, 2019	http://www.icnb.org Lisbon,Portugal

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