CHAPTER 6

NUCLEAR TOOLS TO COMBAT ORGANISED DRUG TRAFFICKING IN INDIA

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1. Introduction

The phenomenon of organised crime is not new to India. Organised criminal gangs have been operating in India since ancient times. They usually preyed on travellers and wayfarers whom they waylaid while traversing lonely routes that passed through thick jungles. Occasionally, they invaded villages and towns and freely indulged in reckless plunder and murder of innocent people. In fact, Gerald Aungier, the first Governor of the Island of Bombay, created a militia of local people in 1669, mostly to control the organised gangs who robbed the citizens and visiting sailors alike.

Over the centuries, the organised criminal gangs have kept pace with the socioeconomic progress of the society. They have proliferated in diverse areas and their activities have been more complex and more potent. Drug trafficking is one such crime which has become a challenge to national institutions and a cause of concern to the whole international community. It results, into huge profits for those who are involved and thus jeopardising the economies of several countries. To achieve their goals, they use violence, intimidation and corruption. The menace of drug trafficking has become global in nature due to phenomenal advancements in the field of communication.

This paper presents the details of the "organised crime" in general and the menace of "drug trafficking" in particular. The paper also highlights the applications of the "Neutron Activation Analysis", a nuclear tool, to pro-

vide modern scientific aids to the investigating agencies in combating the "Organised Drug Trafficking in India".

2. Genesis of The Organised Crime

Before an attempt is made to define "Organised Crime" and examine its important features, it is essential to define the "underworld" organisation which is involved in such crimes. The underworld is a loose social organisation of those who are criminals and delinquent and of the hangers on, and is made of many small units. The underworld is grouped in various forms of criminal behaviour and those closely knit groups are loosely associated with each other. The professional criminals are the main constituents of the underworld and they have their own code of ethics and their own hierarchy. They have a common culture, a common bond and a common code. Having defined the underworld, we define organised crime and enumerate its various characteristics or main features. However, as with any other complex phenomenon, there is no commonly agreed definition of organised crime, as perspectives differ. Edwin Sotherland and Donald Crossey described organised crime as the association of a small group of criminals for execution of a certain type of crime. This is somewhat simplistic definition which fits a "gang" better than the organised crime.

During 1983, Justice W. H. Webster, Director, FBI stated that an organised crime group is defined as a group having some manner of formalised structure whose primary object is to obtain money through illegal activities and maintain its position through the use of violence or the threat of violence, corrupt public officials, graft or extortion and has an adverse effect on the people on regional/national basis. The First International Symposium on Organised Crime, held during May, 1988 at the Headquarters of the International Criminal Police Organisation (INTERPOL) in Saint Cloud, France, adopted a definition of organised crime as any enterprise or group of persons engaged in a continuing illegal activity with the primary purpose of generation of profit, irrespective of the national boundaries.

On the other hand a number of social scientists described it as an integral part of a nations"s social, political and economic life - as one of the major social ills, such as poverty that grew with urban living. Some social scientists describe the practitioners of organised crime as the society"s economically poor young people who lost faith in the capacity of the society to work on their behalf. Because of this perception of society, many such young

people got organised and created counter-cultural structures that, as per their belief, are capable of delivering the kind of emotional support and material goods, the large society promises but does not make available to youngsters like them.

The economists argue that organised crime, at least in its market activities, operates like any other enterprise. The fundamental characteristics of organised crime is that it supplies goods and services declared illegal by the government - illicit sex, illegal alcohol and banned drugs to voluntary customers in a supply-and-demand mode. At the same time, however, organised criminals use the proceeds to finance the related crimes such as hijacking, extortion, resale of stolen goods, and the use of criminal tactics to monopolise business and labour unions. The profits are also used to corrupt public officials and the politicians who, in turn, promote and protect the interest of such criminals.

3. Essential Characteristics of Organised Crime

In this contest, it may be noted that all the above perspectives share certain basic assumptions about the nature of organised crime. These are:

(i) Organised crime is indeed organised i.e., it possesses some form of regularised interaction, roles and structure in whatever form, it has an existence and permanence that transcends individual membership. Because it is organised, it differs from the street crime which is more incident centered and does not involve the degree of planning or the interconnected network of legal and illegal activities which are a characteristic of organised crime. It is a group activity.

(ii) Organised crime has goals and objectives, strategies and tactics to attain these ends and to minimise risks.

(iii) Organised crime is protected in as much as it uses violence or the threat at violence and to an extent depends for its existence on certain degree of corruption and influence in the political and enforcement sectors.

(iv) Organised crime encompasses a wide range of illegal and illicit activities, the major purpose of which is to provide goods and services to an accepting public.

(v) It is headed by a charismatic leader (or a syndicate) and has a rigid hierarchy. Large organisations have multiple separate groups/units - headed by its own leader, supported by a well defined command and control structure. Key members are protected, and insulated.

(vi) Members are formally accepted by the group after they demonstrate loyalty and willingness to commit criminal acts. The life time commitment is enforced through strict discipline or even through violence or threat.

4. History of Drug Consumption by Humans in India

Heaven above does not equal one half of me, Have I been drinking Soma?
In my glory I have passed beyond earth and sky,
Have I been drinking Soma?
I will pick up the earth and put it here or there,
Have I been drinking Soma?

The above scribe from Rigveda clearly indicates that Soma, a hallucinogen, was known to that civilization, when Vedas were written. No body knows when the cult of Cannabis smoking to achieve internal bliss was started by Indian monks. It is still an enigma to tell the period of Lord Shiva in history of time, with whom Cannabis (Bhang) is associated in one way or the other. Bhang is still treated as a holy offering by devotees of Lord Shiva. People in the past (and many even now) never recognised the use of Bhang as an abuse. it was rather taken with spiritual feelings to enhance and expand the mental faculties. The ancient Indians were well aware of many plants which are now treated as the source of drugs of abuse. Historical records reveal that Poppy cultivation started in India during fifteenth century. It is believed that the opium Poppy was first grown in coastal areas of India, and with passage of time, it penetrated into the interiors of peninsula. During Mughal period in India, the opium poppy was extensively grown and it was an important article of trade with other countries, especially with China. During later part of the 16th century, opium was a state monopoly. With the decline of Mughal empire, state lost its control on monopoly of production and its trade passed into the hands of merchants. When East India Company captured India, the monopoly of trade of opium passed into hands of the Company, which in 1757 assumed the charge of collection of revenues in Bihar and Bengal provinces of India. In 1773, Lord Warren Hastings, the then British Resident, brought whole trade of opium under control of the Government. Although, changes have token place in the methods of control of cultivation, processing and sale of opium, the Government still exercises control over it. It may be mentioned here that even during

British rule, the unrestricted cultivation of opium was prohibited in India.

5. Drug Related Organised Crime in India

Abuse of drugs may also cause adverse effects on our international relations. India is a opium producing country. Cannabis is also available as local unwanted crop due to tropical climatic conditions of India. Opium and its many derivatives are available in market by illegal leakage. Three decades back, the menace of drug abuse in India was not too alarming. Geographically, India is sandwiched between the Golden Crescent and the Golden Triangle. During the last two decades, smuggling of very large quantities of narcotic drugs into the country, from across the international borders, has been witnessed. Before this period, the drugs available in the country were only accounted to the leakage from the legitimate sources. Presently there are three sources of supply for the drug trafficking in India:

I. Golden Triangle
II. Golden Crescent
III. Leakage from the local legitimate sources

Due to geographical reasons, the inflow of these drugs into India are almost uncontrollable. The seizures since 1985, as per the reports available, have indicated that 80% of Heroin and 50% of Hashish flowing into the country is from the Golden Crescent. These drugs are smuggled into India through its international borders and almost all the Indian states along the border have fallen victim to this narcotic smuggling. There have been frequent large drug seizures and often the seizures were unclaimed. This has so happened because the flow of transit traffic is quite large and when challenged by the enforcement officers, the culprits abandoned the smuggled goods and escaped to the other side of the international border under the cover of either darkness or thick bushes or sometimes with the exchange of fire. The drugs so smuggled from the borders are finally transported into metropolitan cities like Bombay, Delhi, Calcutta and Madras. Seizures of various banned drugs during the period of 1988 to 1992, giving a glimpse of the problem of drug trafficking in India, is given in Appendix-I.

Wide range of activities are involved in India by perpetrators of drug related organised crime. Terrorist groups could partly survive by the support of outside agencies, whose main aim is to destabilise the country. Their continuation of struggle for such a long time had been possible only due to

the reason that they started generating their own resources by involving in Narco-trade. The basic requirement for survival and flourishing of this trade is that it needs a well organised group and network who can carry the trade at the international level also. The profits of drugs are misused by terrorists to spread fake propaganda through published material and to buy sophisticated weapons as well as high grade explosives. Much of the profit of illegal sale of drugs is diverted by drug traffickers in a wide range of legitimate business. It provides a desired respectability and a future legitimate source of income to the investor. It also provides a cover for tax evasion of huge income of drug sales. The Indian Express newspaper issue of 27th Oct., 1996 reported that the woman behind Mumbai"s Rs. 150 million narco-empire, known as Papa Mani in Police circles, is owning a fleet of buses, immovable property and has personal savings worth Rs. 150 million.

Over the past few year, there has been a considerable increase in the number of scheduled drugs included under international control. This increase reflected into diversification of drug abuse, the consequent increase in regulatory efforts, in turn, resulted in more stringent national legislation and sentencing provisions. At the same time, the seized quantities of controlled drugs such as the opiates, cocaine and cocapaste, cannabis products, amphetamine and related compounds have also shown an alarming and unprecedented increase in certain regions. This situation, involving an increase, both in the frequency and volume of seizures, present a challenge not only to the national law enforcement authorities, but also to the scientists of Forensic laboratories, who are to provide scientific aid to crime investigation.

Owing to the ingenuity of illicit producers and promoters, unexpected new drugs or combination or drugs appear in the illicit market, requiring rapid and adequate action as well as ingenuity on the part of forensic scientists. Similarly, the increase in number of controlled substances and the related legislative provisions place additional pressure on the investigation agencies. Analysts have to deal with more substances and preparations and use faster, more accurate and specific methods of identification and analysis. In addition, the international character of drug trafficking requires the speedy exchange of analytical data between the laboratories and the law enforcement authorities, both on the national as well as on the international levels. Developments of internationally acceptable methods of drug analysis contribute greatly towards achievement of these objectives. By determining the chemical composition of organic components the source or batch identification is not easy. To establish the geographical origin of the seized

drug samples or to identify whether the different drug samples seized con be assigned to a particular lot is a challenging task. The first question is whether the quantitative determination of the main organic components, could lead to source or batch identification. The problem becomes complicated because many factors influence the composition of resin - the genetic properties of the plant, the soil, the climate, the state of maturity at the time of harvest, the storage time and the storage conditions. However, the dominating factors have been the genetic properties. This method of identification met with very little success.

Different species of plants, grown under identical conditions (same soil, same water, same exposure to sunlight) can exhibit different trace element levels, due to their different metabolic processes. Similarly same species of plants, grown under different conditions of soil, water and sunshine also show different trace element levels. As on example, the narcotics grown

Sample	Concentration in parts per million						
	Sodium	Potassium	Scandium	Iron	Copper	Zinc	Bromide
A	244	12300	0.092	82.3	34	--	2.9
B	70	20600	0.017	75.6	339	44	--

in two different regions of India have the following composition.

The difference in concentration of trace elements shows that plants grown even in the same country, but in different regions having different soil and climatic conditions, the trace elements uptake may be different. When identical trace element uptakes are noticed, one can reasonably be sure that the lots may belong to the same batch. This is bound to happen when the production of the resin is in bulk in one place and the homogenised batch is dispatched to different locations. This can be proved that seized drug is a part of the already confiscated batch. In order to establish the identity of any controlled drug, criteria should be at least two independent analytical information. The selection of these parameters in any particular case takes into account the specific drug involved and the available analytical resources.

A. Crime Scenario

Trafficking of narcotic drugs like Cannabis, Opium and Brown Sugar etc. vary as per demand and the trafficking route. The cities like Mumbai and Delhi etc., which are the gateway for the export of these narcotic drugs, encounter large number of cases. In the coastal trafficking, border states like Gujarat, Rajasthan and Orissa predominate. The percentage coextractitities like Papaverine, Codeine and externally added adulterant like Caffeine, Methaqualone, Paracetamol, Diazepam throw light to the origin of the narcotic drugs. On an average, the number of annual drug cases received in a State Forensic Science laboratory, in India, for analysis arid identification are of the order of:

Drugs	Number of Cases
Brown sugar	2000 to 4000
Opium	12 to 80
Cannabis	200 to 1800
Mandrax	10 to 900

B. Cannabis

Cannabis is the oldest drug known to man. It has specific medicinal properties and is known to relieve female weakness, gout, rheumatism, beriberi, constipation, absentmindedness and surgical pain. It was introduced in India about 800 B.C., and was used in the form of bhang, ganja and charas. Cannabis is also popularly known as charas, bhang, ganja (India), Kif, hashish (Middle East), marijuana (Mexico), Bo, charge, grass hemp, greenhay, pot, reefer (USA). In the literature it is also known as the Heavenly Guide, Poor Men"s Heaven, Hero Leaved, Light Heart etc. Various species of the Cannabis plant grow throughout the temperate climates of the world. The strength of the Cannabis resin depends on soil conditions, time of harvesting, and the period of storage between harvesting and use. Marijuana is a drug derived from the Indian hemp plant and was classified by the Swedish botanist Linneaus, in 1753, as Cannabis Sativa Linn. It is practically naturalised in the sub-Himalayan tract in India. The plant is a tell annual herb 4 to 16 feet, in height. The leaves are compound, with five to eleven leaflets, seven being the usual number. Flowers and seeds grow at the top of the plants and at the ends of the branches.

Cannabis Sativa has traditionally been processed to yield three rough grades of hallucinogenics known as "mind-expanding" or psychedelic materiel. Bhang, Ganja and Charas are the three forms of Cannabis mostly used in India and other parts of the world. Bhang also known as Sidhi, Patti, or Subji is the least potent preparation consisting of the dried matured leaves, twigs and the fruiting shoots from both male and female Cannabis Sativa plant. It is ground to a thick paste, mixed with sugar, milk, fat and is used as a drink. In USA, the dried leaves also known as marijuana of low potency are smoked in cigarettes known as "reefers". Ganja also known as Marijuana or Marihuana abroad and Baluchar or Ganja, Yela in Tamil and Bangiku in Southern India. It consists of the flowering or fruiting tops of the cultivated female Cannabis plant which became coated with a resinous exudation. The drug is smoked in hand - rolled cigarettes or in a pipe. Charas also known as Sulpha, Nasha, Hashish or Marihuana is the crude resin collected from the leaves and flowering lops of the female plant. It is obtained by rubbing the tops between hands, beating them on cloth or by natives wearing leather aprons walking among the growing plants. The resin sticking to the apron is scrapped of and made into cakes of pith like substance. It is marketed in the form of small balls and cylindrical pencil rods.

There are at least 419 known chemicals that have been isolated from the plant Cannabis Sativa Inn. Among the 419 chemicals, 61 are known Cannabinoids. Cannabinoids are the active ingredients of Cannabis Sativa. The characteristic action apparently is mainly due to a group called Tetrahydro-Cannabinols (THC). In the 1960"s Dr. Raphael Mechonlam at Hebrew University in Israel successfully produced synthetic THC. THC is the most prominent psychoactive Cannabinoid compound, and its gradient determines the potency of Cannabis. The chief ingredients isolated from a Cannabis plant are (I) Cannabinol (ii) Cannabidiol (iii) Cannabidiolic acid and (iv) Tetrahydro Cannabinol.

C. Toxic Reactions of Cannabis

Cannabis has both physiological and psychological effects. Some people are not susceptible, however, assuming one is, and assuming that one has just deeply inhaled its smoke, the effects will be almost immediate and will last from one to three hours. Taken in food or drinks, the first effect will take from half an hour to one hour to begin and can lest for about four hours. The dilation conjunctival flush, "red-eye" - is probably the only prominent physical sign during the initial stage of intoxication. After inhalation of Cannabis, the user has a feeling of inner joy, that is far out of proportion

. There may be comfortable feelings of relaxation, euphoria, reduced inhibitions, and freedom from anxiety. Cannabis like all other drugs can be dangerous. It has no current accepted medical uses and it has been legally banned in almost all the countries. These strict measures have been taken because long experience has shown that Cannabis has damaging effects on a large proportion of the people who use it.

6. Statutory Controls in India to Combat Organised Drug Trafficking

Statutory control over narcotics has been exercised in India through a number of Central and State enactments. The principal acts viz. Opium Act 1857, the Opium Act 1878 and Dangerous Drugs Act 1930 were enacted long time ego. With the passage of time and introduction of new drugs of abuse and punishments provided in these acts were not sufficient to control the drug menace. The Scheme of penalties under these acts were not deterrent enough to meet the challenges of well organised gang of smugglers. The Dangerous Drugs Act 1930 provided a maximum imprisonment of 3 years with or without monetary fine and 4 years with or without monetary fine for repeated offences. No minimum imprisonment and fine was provided under these acts. As a result, the drug traffickers were being let off by the courts with nominal punishments. For the past few years, India had been increasingly facing the problem of drug abuse as it became a transit country for smuggling of drugs from the Golden Triangle and the Golden Crescent countries to western countries. These acts did not provide investigation powers to a number of important Central Enforcement Agencies such as narcotics, customs, central excise etc. Some new psychotropic drugs of abuse have been introduced and under the old laws there was no provision to exercise control over them.

With the above deficiencies in view, an urgent need was felt to amend the existing laws and accordingly Narcotic Drugs and Psychotropic Substance (NDPS) Act 1985 was introduced by the Government of India. This act provided deterrent punishment for drug trafficking offences. Initially, even though the major offences were non-bailable by virtue of the level of punishments, but even then, on the basis of technical grounds, drug offenders were being released on bail. Hence it was felt that the NDPS law requires further amendments. A cabinet sub-committee constituted for combating drug traffic and preventing drug abuse, also made a number of recommendations for strengthening the existing act. These amendments pro-

vided:

(I) Formation of a National Fund for control of drugs of abuse to meet the expenditure involved in connection with the measures for combating illicit traffic and preventing drug abuse.

(ii) To bring certain controlled substances which are used for manufacturing the narcotic drugs and psychotropic substances under the purview of NDPS act 1985.

(iii) To provide for pre-trial disposal of seized drugs.

(iv) To provide that no sentence under the act shall be suspended, or committed.

(v) To provide death penalty on second conviction in respect of specified offences and involving specified quantities of certain drugs.

(vi) To provide for forfeiture of property and a detailed procedure for the same.

(vii) To provide that the offences shall be cognizable and non-bailable.

Therefore, in view of NDPS Act, the court is to strive to safeguard the interest of the state as to protect and advance the objective and purpose of enactment. Any narrow or technical interpretation of the provisions would defeat the legislation and therefore, court shell be required to keep the legislative policy in mind while applying the NDPS Act. The scale of punishments for offences under NDPS Act and its various sections, have been summarised in Appendix-II.

The property of a person can be forfeited by the Government, if he is convicted under the NDPS Act for 5 years imprisonment in India or abroad or against whom the order of detention~ under PIT NDPS Act has been passed. The property included all assets and properties - moveable or immovable, deeds and instruments etc. derived from or used in illicit traffic, acquired upto 6 years prior to the date on which the person was charged for an offence relating to drugs. Holding and acquisition of aforesaid properties by any person is an offence and the person can be prosecuted besides the property being forfeited. To further combat the problem, the following measures have also been adopted:

(i) Strict surveillance at all import inlets to prevent smuggling of drug into India.

(ii) Surveillance along the known drug smuggling routes.

(iii) Strict surveillance at all export outlet points.

(iv) Coordination among various drug enforcement agencies.

(v) To identify and destroy illegal cultivation of drug bearing plants.

(vi) International Coordination through Interpol for collection of intelligence and further enforcement measures.
(vii) Severe penalties for drug offenders under NDPS Act. Prior to enactment of this act, the penalties for drug offenders were quite lenient and it was not possible to check them effectively. Under those acts many new drugs were not even notified as prohibited drug.
(viii) Training of Drug Enforcement Officers for effective functioning and enforcement of drug laws.

7. International Measures to Combat Organised Drug Trafficking

Benevolent elite of some countries, felt the pinch of harm caused to the public when narcotic plants or their produce are brought to their geographic territories. During 18th century, Chinese rulers tried to stop opium smoking and its supplies from India by the Portuguese and British traders. Chine, in a bid to stop opium trafficking into their country, fought two wars with the British and their allies. As a consequence of the first defeat, China parted with Hong Kong and other territory to Britain in 1842. In the second defeat, during 1858, China was forced to legalise transportation of opium into their country. During the end of 19th century China as well as USA, in their colony of Philippines, felt great concern with the problem of drug addiction. Thirteen countries participated in a meeting known as the "Shanghai Commission" in 1909 at Shanghai. The Commission passed nine resolutions. The salient features of these resolutions were that the right of China to eradicate the opium abuse be recognised. Control over sale and distribution of opium and its production at the national level and also the measures to a prevent shipping of opium to other countries was urgently required.

The Shanghai Commission was the first ever effort which could focus world attention on the dangers of drug abuse and protection of health as measure towards the welfare of mankind. Drug problem gripped many nations during the beginning of 19th century and it started becoming an international phenomenon at a much higher scale. The International efforts further resulted in the First International Opium Convention which was signed at Hague on 23rd January 1912. The resolution of the Convention was followed by many countries by including them in their national legislation. It helped in restricting the production, importation, possession and use of opiates. Emphasis was laid that on humanitarian grounds and it was resolved that the drug abusers should be treated like sick people. During the middle

of 19th century, drug abuse else shifted from plant origin to synthetic drugs like LSD and Amphetamine and the period was celled "Flower Power Era". The United Nations Drug Convention came during 1961 as the single Convention in narcotic drugs, which was signed by 124 countries. The same Convention was further amended during 1972 to which 101 states became signatories. During 1988, another Convention was held at the United Nations to combat illicit trafficking in narcotic drugs and phychotropic substances. These integrated and universal efforts by the member countries of the United Nations cell far waging a war against the drug abuse. India, also being a signatory to these conventions, has an obligation to implement the provisions of the United Nation conventions.

The Convention emphasised the need and the responsibilities of different member states for carrying out their obligations. It also laid down same guidelines and procedures for the confiscation, storage, destruction and disposal of seized property in cases of illicit traffic at sea, by air and through postal mail. Guidelines on the issues relating to eradication of illicit cultivation of drug bearing plants, extradition of foreign criminals and furnishing of information to the commission on the narcotic drugs.

8. Instrumental Neutron Activation Analysis (Inaa) of Cannabis

The identity of Cannabis can be established by microscopic examination and chemical and physical tests. It has been stressed that the botanical examination of Cannabis should not be based only on the presence of cytoligh hair. The presence of resin glands, multicellular hair or other histological features should also be verified. Chemically, the color production in presence of Cannabis establishes its identity. The tests are based on the formation of color with Cannabinoids. Physico-chemical tests used to identify Tetrahydrocannabinols (THC) in suspected cannabis samples very with the technique and the equipment employed.

These tests are sufficient to establish the identify of the sample but quite inadequate to identify the source, i.e., the country or the place of origin. Furthermore the last mentioned tests are quite tedious and time consuming. Attempts have been made in India to determine the trace element concentration in Cannabis samples and to quantify the same with a view to establish the source identification. The Instrumental Neutron Activation Analysis (INAA) was utilised for this purpose. As the method was found inadequate for the analysis of some elements, the method of Inductively

Coupled Plasma Atomic Emission Spectroscopy (ICP - AES) was used for some elements. As the large amount of organic material in the sample is bound to interfere in the ICP - AES analysis the method adopted was to first destroy the organic matters preconcentrating the trace elements.

For the determination at trace elements in Cannabis using the technique of INAA, five test samples were obtained from the Orissa State Forensic Science Laboratory, Bhuvaneshwar. The exact locations of the source of the samples were not known. The choice of the sampling procedure greatly influences the accuracy of any method for the determination of trace elements by any analytical method. The samples were obtained as powder with small lumps and mostly contained the leaves and the stem of the plant. The samples were first dried at 110°C fare period of 2 - 3 hrs and then 2 g of the dried samples were homogenised by powdering in a cleaned agate mortar with an agate pestle. The homogenised sample was kept in a closed bottle in a desiccator.

A. Irradiation

Most of the irradiation"s were carried out in the "APSARA", a swimming pool type reactor and in the "CIRUS", a natural Uranium, heavy water moderated reactor. All the samples prepared for APSARA irradiation were double sealed in clean polythene bag with the sample identification in the outer bag. This outer bag was removed after each irradiation, the outside of inner bag cleaned with acetone and sealed in fresh polythene bag prior to counting. Samples for irradiations in the CIRUS reactor were wrapped in Aluminium foils. In CIRUS, the flux is higher and because the sample is exposed to air, the sample in the polythene packing may get heated up. The aluminium foil is used to prevent any such eventuality.

B. Experimental Measurements

Measurements were made using a Lithium drifted Germanium Crystal Gamma Ray detector coupled to a pulse height analyser system. The relevant empirical data bank of the nuclear reactions involved in the identification and quantification of the trace elements in Cannabis samples has already been generated. To create the date base, different fluxes and different periods of irradiation had to be used to achieve the sensitivity to determine a particular element. Trial and error method was used to determine the required time of irradiation. The empirical data thus generated involved the element determined, the target isotope produced, the nuclear reaction, the effective reaction cross section in barns, the isotopic abundance, the time of

irradiation used, the reactor used, the neutron flux and the optimum time elapse after irradiation for counting these data have effectively been utilised in the analysis of the drug samples. Counting is done for different periods, and for each elements determined, the characteristic half-life is also evaluated. A typical gamma-ray spectra of the Bowen"s Kale standard is obtained for a period of irradiation of 6 hrs at a fixed flux. The graphical representations of the Gamma-ray spectra are obtained for different Cannabis samples. These curves are read with respect to different time of irradiations, different weight, different periods of counting etc., and are representative patterns of the spectra rather than a fully qualitative picture. The amounts of different elements in the samples are then determined by comparison with the values of the concentrations of different elements evolved earlier tar the Bowen"s Kale standard. The presence of the elements (viz., Cl, K, Sc, Mn, Fe, Cu, Zn, Br, and Hf) are evaluated with the most suitable photopeak obtained in the Gamma-ray spectra for the specific sample. When the Drug Enforcement Agencies seize a large quantity of illicit cannabis but the smugglers are able to escape with the drug, it can be proved that the seized drug is part of the already confiscated batch.

The Table in Appendix-III gives a typical set of data of the trace elemental composition of 5 Cannabis samples supplied by Forensic Laboratory, Orissa. The Table comprises the quantification of 22 trace elements, out of which 9 elements (viz., Cl, K, Sc, Mn, Fe, Cu, Zn, Br, and Hf) were determined by INAA, while 13 elements (viz., Al, Co, Mg, B, Cr, Mo, Ni, Be, Pb, Zr, Cd, Si, Ti) have been determined by ICPAES. This method fells short for the determination of several other elements in Cannabis. The sophisticated technique of ICP spectroscopy has been utilised for generating additional informations. In this case, it is worth mentioning that the concentrations of 4 elements (Hf, Zr, Be, and Sc) are so small that the consideration of their concentration will net be very rational, as far as the present investigations go. Further, these elements are so rare that the possibility of their existence in soil and the consequent pick up by the plants from the soil become improbable. The values of Co also seems to be inordinately high and strong interference at the wavelength of 243.2 nm, at which these measurements were done, can be expected. Attempts to identify the interference were not successful and this renders the validity of the values of Co concentrations doubtful. This leaves 17 elements from which comparisons can be made. A perusal of this Table shows that no two samples are exactly the same, in the sense that their trace elemental compositions agree within

the experimental error. However, it is seen that samples A and B differ from the other three samples C, D and E with respect to at least 10 elements and hence must be considered as different from others. A comparison of the compositions of A and B shows relative differences which provide a clue that they are also not from the same batch. As far as C and D are concerned, they have similar elemental composition far 9 elements; Cl, K, Br, Mo, B, Ni, Pb, Cd and Ti. About C and E, it can be said that a similar composition is noticed far only 6 elements, viz., Mn, Cu, Mo, Al, Cd and Pb while for D and E the similarity ends with 6 elements, viz., Zn, Cu, Fe, Mo, Cd and Ti. It is significant here, that, between them, three elements, Mo, Cu and Cd are common, while it is only for Cu and Mo for C, D and E. The foregoing comparison leads to a conclusion that samples C and D are from the same batch, while the rest of the samples are from different batches. An overall comparison makes one conclude that all the samples are from the same "source" or "region", though it cannot be specified from which country the supply has come.

A limited study of 30 opium samples from 20 different locations of the world far 7 elements was conducted. The technique employed was INAA and the results needed validation due to the uncertainty of the standards used. However, the numbers are indicative of the magnitude. The Potassium content is a definite indication, as out of the 30 locations, only 8 locations alone, (including two from India), have value above 10,000 ppm. Comparison of the K content of 5 samples in the present work two of them suggest a similar origin. The geographical conditions of Philippines suggest that the Indian sample mentioned and the 5 samples in the present work must have originated from the more tropical climate of India, most probably Kerala. For further comparison, the Table in Appendix-IV lists the values of nearly 7 elements which are available in the literature. A comparison of the values given in these two Tables shows that Fe content is higher for all the 5 samples in the present study, whereas very law values at Cu are noticed. The Br values are similar, but locations in Philippines and Laos B give higher Br content. This points to the same origin, but different lots or batches. Also it is clear that origin of the 5 samples are not from any of the aforesaid 20 locations.

9. Future Plan

Comparison of chemical compositions and particularly the concentration levels of trace elements and micro-constituents would be of great help

to establish the geographical origin and to opine whether different drug samples seized can be assigned to a particular lot. However, the task is formidable because of the complexity of the problem, as large number of chemical constituents degrade due to storage as well as temperature, humidity and light effects. Keeping this in mind, the work has been planned in two ways. First by establishing the concentabration profiles of various constituents in number of samples of known origin. Emphasis will be given to study and establish the variation (if any) of concentration profile due to different natural parameters like heat, light, humidity etc. Secondly, a relatively easier and more promising method is to be evolved to establish the concentration profile of trace elements. These two exercises will not only establish the geographical origin but also may lead to a pattern recognition process. The objective is to develop methods for separation, characterisation and determination of organic components and trace elements in Cannabis and narcotics for source correspondence, to establish commonness of origin or otherwise.

Most of the existing chemical methods are directed towards the establishment of the identity of Cannabis primarily in the biological fluids. No significant effect has been made for source correspondence studies and origin of the drug. It has been proposed to conduct a systematic study on the concentration profile of various organic components and trace elements. The various degradation effects due to heat, light and other natural parameters would also be studied far extrapolating the results to current time. The relation between the concentration profiles, particularly of trace elements, is likely to give clearer picture about the source and the geographical origin of the sample. The characterisation of organic components and their determination would be effected through TLC, HPLC, GC and other relevant analytical techniques. The trace elements would be determined by combination of analytical techniques like Neutron Activation Analysis (NAA), Atomic Absorption and different spectro-chemical methods.

APPENDIX-I

SEIZURES OF BANNED DRUGS DURING THE PERIOD 1988-1992

Name of the Drug	seized	year	Qty. in Kg.
No. of cases			
Opium	1988	3304	512
	1989	4855	1668
	1990	2114	506
	1991	2145	566
	1992	1813	1121
Morphine	1988	23	24
	1989	92	14
	1990	6	27
	1991	6	21
	1992	32	149
Heroin	1988	3029	489
	1989	2714	1248
	1990	2193	764
	1991	622	1158
	1992	1133	2466
Cannabis	1988	45994	592
	1989	54463	3612
	1990	39090	1782
	1991	52633	3140
	1992	58934	5374
Hashish	1988	17523	419
	1989	8179	687
	1990	6388	753
	1991	4413	335
	1992	5825	2161
Methaquolone	1988	1649	40
	1989	887	725
	1990	2141	60
	1991	4415	78
	1992	7475	167

APPENDIX-II

Sr. Description of Offence	Minimum/Maximum punishment	
No.	Rigourous Imprisonment (Years)	Monetary Fine (Million Rs.)
1. For contravention of law for cultivation, production, manufacture, possession, sale, purchase, transportation concealment, use or consumption, import/export (inter-state) Poppy straw (Section 15). Coca Plant & Coca leaves (Section 16). Opium Poppy, opium and prepared opium (Sec. 17, 18 & 19), Cannabis and Ganje (Sec. 20). Manufactured drugs & preparations (Section 21),and all Psychotropic substances (Sec. 22).	10 to 20	0.1 to 0.2
2. Punishment for illegal import into India, export from India, or transshipment of Narcotic Drugs and Psychotropic substances (Sec. 23).	10 to 20	0.1 to 0.2
3. Punishment for external dealings in Narcotic Drugs & Psychotropic Substances in contravention of Section 12 (Sec. 24).	10 to 20	0.1 to 0.2
4. Punishment for knowingly allowing premises,enclosure, space, place, animal or conveyance knowing for commission of offence (Sec. 25).	10 to 20	0.1 to 0.2
5. Punishment for production, manufacture, possession, import/export inter-state sale/purchase, consumption, use, storage, distribution, disposal or acquisition of any controlled substance (Sec. 25 A).	10 to 20	0.1 to 0.2
6. Punishment for certain acts by licensee or his servants (Sec. 26).	Upto 3 years imprisonment or fine or both	
7. Punishment for illegal possession in small quantities for personal consumption of Cocaine, Morphine, Diacetylmorphine or any other Narcotic Drug or Psychotropic Substance, as may be notified by Central Govt. (Sec. 27).	Upto 1 year imprisonment or fine or both	
b) Punishment for illegal possession in small quantities for personal consumption of narcotic drugs or psychotropic substance other than those specified above (Sec. 27).	Upto 6 months" imprisonment or fine both	
8. Punishment for financing, directly or indirectly,abetting or conspiring in furtherance of an offence or harbouring persons engaged in the above mentioned activities (Sec. 27 A).	10-20	0.1 to 0.2
9. Punishment for attempts to commit any offence under chapter IV of the act or cause such offence to be committed and if such attempts do any act towards the commission of offence (Sec. 28).	As provided for the particular offence.	
10. Punishment for abetment and criminal conspiracy to commit an offence punishable under chapter IV of the act, whether such offence be or be not committed (Sec. 29).	As provided for the particular offence.	
11. Punishment for preparation to do anything or commission to do anything which constitutes an offence punishable under any of the provisions of Sec. 15 to 25 (Sec. 30).	Half the normal punishment	
12. Repeat offence (Sec. 31)	Double the normal punishment	
13. Punishment for subsequent conviction in respect of commission of or attempt to commit or abetment of, or criminal conspiracy to commit an offence relating to production, manufacture, possession, transportation import into India, export from India or transhipment of Narcotic Drugs or Psychotropic Substances or specified quantities of certain drugs as mentioned in Sec. 31 A.	Death penalty	
14. Addicts volunteering for treatment (Sec. 64 A)	Immunity from prosecution.	

APPENDIX-III
Trace Element Composition of Cannabis Samples - Consolidated Data

Element	Concentration in ppm				
	A	B	C	D	E
Cl	3,000	1,250	900	900	750
K	20,000	19,150	13,530	14,200	17,900
Sc	0.028	0.009	0.004	0.024	0.024
Mn	170	320	245	220	250
Fe	255	200	400	230	230
Cu	5.2	4.7	3.3	3.5	3.5
Zn	80	20	15	65	65
Br	9.5	10.5	5.5	6.0	8
Hf	0.025	0.025	0.025	0.025	0.020
Al	626	360	430	137	412
Co	4,970	5,957	5,830	5,811	5,497
Mg	9,937	13,937	13,571	12,015	13,128
B	53	54	45	48	39
Cr	20	19	18	20	18
Mo	16	16	16	16	16
Ni	8	12	12	10	14
Be	0.3	0.2	0.3	0.2	0.2
Pb	264	304	293	271	306
Zr	0.7	0.5	0.3	0.4	0.4
Cd	1.4	1.2	1.3	1.0	1.2
Si	11	45	28	13	17
Ti	14	12	3	4	5

APPENDIX-IV

Comparative Value of Trace Element Compositions of Narcotics of Various Origins*

Country of Origin	Concentration in ppm						
	K	Sc	Fe	Cu	Zn	Br	Mn
Greece A	10,080	0.026	35.5	104	251	—	11.65
India A	12,000	0.092	82.3	34	—	10.9	—
India B	20,000	0.017	75.6	339	44	2.9	—
Indonesia A	12,600	0.800	28.0	38	198	—	—
Laos B	16,380	—	—	106	11	86.0	—
Lebanon	12,000	—	35.4	98	35	9.2	0.84
Philippines	19,680	—	49.0	39	60	38.4	—
Yugoslavia	14,600	0.027	80.5	—	442	5.2	—

*Perkons A. K. Modern Trends in Activation Analysis. J.R.Devod. NBS, Spl. Publ. 312, Vol.1, p.263, (1969)