

Reuse API (Active Pharmaceutical Ingredients) from Expired Dosage form

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Abstract:- Drugs plays important role in our day today activities in order to prevent diseases and their treatment. A mythology is famous among people that drugs become toxic and dangerous after expire date but actually it's not like that, there is simple decrease in the therapeutic effectiveness of drug dosage forms. But after expire date we cannot use them and throw them without knowing that these drugs have lethal side effects on living organisms present around us. Reuse of expired drugs that are present around us because these drugs are not safe for living organisms. I design a procedure through which we can extract API from expired drugs and reuse to synthesize such chemicals or compounds which are useful as disinfectants. In this I extract aspirin from expired drug and further this converted into salicylic acid which further undergo decarboxylation to give phenol which is an effective bacteriostatic and bactericidal. Through this we design a proper disposal method for expired aspirin tablets. Aspirin tablets when triturates and react with 0/1 M solution of $\text{Fe}(\text{NO}_3)_3$ it gives brick red color .Where acetyl salicylic acid react with 0.1 M $\text{Fe}(\text{NO}_3)_3$ it gives yellow color. In another hand when we react salicylic acid with same reagent it gives purple color. These identification tests help me to know that my project is in right track.(1)

Keywords: Bacteriostatic; decarboxylation; disinfectants; lethal

(A) INTRODUCTION

Drugs plays important role in our day today activities in order to prevent diseases and their treatment. A methodology is famous among people that drugs become toxic and dangerous after expire date but actually it's not like that, there is simple decrease in the therapeutic effectiveness of drug dosage forms.

But after expire date we cannot use them and throw them without knowing that these drugs have lethal side effects on living organisms present around us. Sometime these effects are beneficial and sometime it may be lethal.

ASPIRIN is well known ANALGESIC DRUG which can we use in plants in order to promotes the growth of roots of plant, and aspirin also help the flowers to survive for longer period of time even in harsh conditions after detached from the parent body of plants.

Experimentally it was found that higher dosage of ACETAMINOPHEN can cause death of cats and dogs. And in humans it causes gastric irritation and vomiting. Drugs effects also depends upon the BMI (Body Mass Index), hence action of drugs may sever in lower living organisms that might we responsible for extinction of living organisms.

Nature works on simple law that what actions we do that always result in similar and opposite reaction. Some API has potency to cause Geneotoxicity which may further cause modification of genetic information in humans and living organisms.

So it is effective step to prevent non-beneficial and undesirable activities of expired drugs. In this case we simply try to extract API and use it in the synthesis of various drug derivatives for study purpose in laboratory which is found to be quite economical. We simply try to recycle that percentage of drug in educational purposes that we discard without knowing their effects on our surroundings. By designing economical extraction methods, we can extract wide range of drugs from their corresponding dosage forms.

This reused quantity of drugs helps us to decrease the chemical pollution to fewer extents. This approach is effective against medical waste management. Extraction procedures can be modified according to the nature and type of dosage forms or the API (Active Pharmaceutical Ingredient) present in dosage forms.

Recently it was found that aspirin is used to revive tropical fishes from shock. But sometime these activity leads to worse when amount or concentration of API is increased in natural habitats.

Synthesis of dosage forms or new active pharmaceutical ingredients should be done by using principles of green chemistry, green chemistry approach is a way to reduce lethal effect on nature, because procedures we use during synthesis of drugs are long chemical processes and quantity of waste materials formed are very high and yield is very low.

Green chemistry opens the doors to design eco friendly reaction procedures and synthesis in which we can reduce the formation of waste materials and increase the yield of reaction procedures. Microwave assisted reaction also helpful in order to decrease reaction time in which reaction completed.

Here the list of medicines recommended by food and drug administration U.S. that you should flush when they are no longer needed, In other words these drugs are recommended for disposal by flushing.

Benzhydrocodone /Acetaminophen Apadaz Buprenorphine Belbuca, Bunavail, Butrans, Suboxone, Subutex, Zubsolv Fentanyl Abstral, Actiq, Duragesic, Fentora, Onsolis Diazepam Diastat/DiastatAcuDial rectal gel Hydrocodone Anexsia, Hysingla ER, Lortab, Norco, Reprexain, Vicodin, Vicoprofen, Zohydro ER Hydromorphone Dilaudid, Exalgo Meperidine Demerol Methadone Dolophine, Methadose Methylphenidate Daytrana transdermal patch system Morphine Arymo ER, Embeda, Kadian, Morphabond ER, MS Contin, Avinza Oxycodone Combunox, Oxaydo (formerly Oxecta), OxyContin, Percocet, Percodan, Roxicet, Roxicodone, Roxycodone, Targiniq ER, Xartemis XR, Xtampza ER Oxymorphone Opana, Opana ER

Tapentadol Nucynta, Nucynta ER Sodium Oxybate Xyrem oral solution.

Safe disposal of drugs is important and we should aware regarding type of disposal methods we are using because exposure of some drugs to living organisms might be harmful. For disposal information please visit Drugs@FDA.

In developing countries medicines are expensive every pharmaceutical companies have different retail prizes. Maximum drugs in developing countries are sold without a prescription, (SELF MEDICATION) and very little part on the basis of prescription. After a drug course when a drug user feel better he stop using medicines, but the remaining quantity of drug no longer in use and undergo improper disposal.[1].

There a book which was reprinted 8 times by WHO, First published in 1992 is a way to investigate drug use in communities, a small but important book. Self medication by individual is not safe because sometime these drugs show lethal side effects without adjusting or calculating there dose for whole day. Self medication is more common in developing countries.

An eye sight should be kept by government health departments on use of medicines in community because abuse of these medicines is common now a day's especially in PHARM PARTIES (when a group of teenagers get together to share drugs and have a good time).

Drugs are not a simple things they might be life saving or sometimes life destroying one. Misuse of drugs especially antibiotics are more common, in which patient frequently shift their courses of medicines from one antibiotic to another which like a threat for their life, because self medication immediately develop resistance in them. A new exposure to infection makes their treatment more complicated.

WHO manual provides a practical guide to the methods that can be used to?

- investigate the use of medicines by patient to highlight problems.
- Action taken to improve a medical disorder.
- Measure fluctuations.

Health workers undergo training for proper use and distribution of drugs in community, health representatives, pharmacists and nurses should take care of these things which are related to the drug use in communities. A long term exposures of drugs not good; mainly due to self medications. Dependency on drugs have lethal damages on vital organs of human beings, excess production of these medicines have direct impact on our surroundings which due to excess abuse of medicines. [2].

Waste drugs, from doctor's prescription, self medication and over the-counter medicines for human and veterinary use, are now widely spread in surface water, groundwater and seawater worldwide. Traces of these drugs in water is major health and environmental concern that is very likely to worsen, expected increase in the use of pharmaceuticals due to higher standards of living worldwide, a growing and aging world population, and the correlated increase in animal farming. So far, more than 150 different

pharmaceutical substances and metabolites have been found in various water bodies in Europe, including in drinking water supplies. Clofibrac acid is an herbicide; it functions as a plant growth regulator against the plant hormone auxin. Clofibrac acid is also a naturally occurring pharmaceutical compound, having been found in Swiss lakes and North Sea.

Other class of drugs used for the treatment of different conditions are metabolised by human beings and some of them are fully metabolised or transformed into different polar forms in order to enhances their excretion but some drugs are excreted as it is which shows some lethal side effects on living organisms.

Rate of excretion of drugs in human beings directly depends on their age factors, with the increase in age ability to metabolise the drugs reduces. Administration of drug in some developing countries like Afghanistan and India is not effective due to malpractices of health providers or workers; somewhere there is not a proper filtration system in education departments to differentiate the quality students. In India quota system make Indian health system weaker day by day which should be take in consideration as soon as possible.

Some drugs which are metabolised or use in agriculture have greater impact on nature which leads to biological magnifications in living organisms. Health systems in developing countries need some changes that especially clear the duties between a doctor and a pharmacist. In developed countries like USA a Doctor only diagnoses the patients and pharmacists prescribed the drugs.

In 2004 misuse of antibiotics are common in communities which leads to antibiotic resistance, but today to treat a new infection become a task to doctors due to malpractices of antibiotics during 2004 or before. Quick shuffling of antibiotics mainly leads to resistance in most case due to self medications. AIDS and TB need long term treatment in order to ensure the health of patients; such chronic diseases are difficult to treat in such patients that show resistance to antibiotics.

Differing environments. Treating AIDS is even more difficult, with lifelong therapy to be taken at least twice a day. Understanding what can be done in the community to help patients take all of their medicines will be crucial for ensuring the success of treatment and preventing the emergence of resistance.

Another pathway is incorrect disposal of drugs usually flushing into sewers from the toilets or sinks or disposing drugs into waste bins. Household pharmaceutical wastes that disposed usually through toilets can reach waste water treatment plants, these plants have different grindings in different countries and they are not able to remove pharmaceutical waste in water and after this process water directly introduce into rivers and fresh water resources which cause contamination such pharmaceutical residues have lethal impact on that particular contaminated area. Therefore we need to develop powerful waste water treatment plants that are able to remove any type of contamination in water and make it safe for use not only for human beings but also living organisms around us.

Detoxification of harmful molecules in our body is important in order to make our body fit and fine, but some time drug we administer remain as it is in our body and it excreted as it is without any change mean drug is in its active form and its side effects on living organisms is more as compared to other drugs that are converted into polar forms in order to facilitates excretion from body. Very low concentration of active drug is enough to cause lethal damage on living organisms. Human beings always took about development and golden era of health but he just trapping himself in web which is full of disappointments and diseases, it was found there is 20-30% increase in diseases due to contamination of natural resources. This number of diseases cases increases day by day, It is simple if nature healthy we are healthy nothing else, simple we have to respect our nature and living organisms around us, because each living one have important role to play in nature. We have to care not only our health of other living organisms is also important for us. Contamination in nature is more in case of developing countries such as India, Pakistan, and Afghanistan because construction of residences is not according to rule and regulations; such residences also lack proper drainage systems, due to which this contaminated water is directly introduced into the main river streams which a unhealthy practice and need to be rectify as soon as possible to prevent irreversible damage to that particular biological zone.

Some drugs in nature remain as it is which a matter of worry and these drugs have some lethal effects, concentration and amount of drug present in nature is unknown and this concentration decides the type of impact that a drug can deliver on the nature. There may be additive and synergistic effects.

Aquatic organisms are the one who most affected by this pharmaceutical residues in water. The FEMINIZATION (shift in gender role and sex role in society) DEMASCULISATION (remove testicles of a male animal) of male fish are attributed estrogens which are formed as by-product in industries. This FEMINIZATION and DEMASCULISATION is due to ESTROGEN that flush out in sewerage and such effect on fish simply make them disable to reproduce and survive effectively. Human scarifies hole population of fishes for healthy of bunch of people. These effects of drugs can be stop by proper disposal techniques one of them is highlighted in my research work in which I design a extraction technique in which reuse the expired aspirin tablets. I simply convert aspirin into salicylic acid then into phenol (which act as bacteriostatic or bacteriocidal floor cleaning agent named EXPIRO PHENOL) and CRUDE OIL METHYL SALICYLATE which is a topical painkiller. In low concentration METHYL SALICYLATE is used as flavoring agents in chewing gum and mints. When mixed with sugar and dried it is a potentially entertaining source of TRIBOLUMINESCENCE, this effect can be observed by crushing wintergreen life savers (a brand of candies in U.S.) in a dark room. Methyl salicylate obtained from expired aspirin tablets cannot use for living stock but can use on nonliving stock e.g. methyl salicylate is used in

restoring (temporarily) the elastomeric properties of old rubber rollers, especially in printers.

Discovery of new drugs and other health system is good approach but these developments have both advantages and disadvantages, especially the market of antibiotics are very huge and these antibiotics distributions and uses not in a proper way this simply due to malpractice in health systems. Frequent use of antibiotics in patients cause serious problems which is not reversed at all. Antibiotics when come in contact with nature it cause genetic mutation especially in aquatic species, such mutations termed as geneotoxicity. Concentration of antibiotics in nature also has bad impact on that microorganism that plays a vital role in biological system. So these microorganisms are completely destroyed due to unwanted concentration of antibiotic drugs in nature. With the increase in production and use of antibiotics, these residues of antibiotics in nature increases day by day, and the impact area also enhances.

Environmental impact of medicines in European market reduced, pharmaceuticals have to undergo an authorisation process. This change in European constitution indicates a healthy practice, where an applicant should indicates the potential risk by medicinal product for the environment, this process of authorisation ensures the proper use and disposal of drugs and support conservation of nature. Such effective rule should be design for every country and nation. Collection of unused drugs from houses and other medical facilities is an effective step towards the proper management of these unused drugs.

Government should construct such rules according to which expired or unused drugs are collected by people and undergo proper processing; this collection of unused or expired drugs is an only hope to prevent the unwanted effects of expired drugs. Collection scheme should be strict and should regulate by government effectively. Today pharmaceutical waste reuse is a better option for us because it provides two things that is a new product to use on non living stock and an effective recycling of pharmaceutical wastes.

Formation of an effective frame work that deals with the pharmaceutical wastes in environment and reduces the risk or damages due to pharmaceutical wastes. Reuse pharmaceutical wastes look more effective as compare to disposal or dumping the pharmaceutical wastes because it increases the chances of contamination from soil to water during rain. Appropriate system is one which is strict and do not come under any influence that rule should be same for both V.I.P and a common man, if someone do not obey or disrespect the pharmaceutical waste collection authority he or she deserve fine or punishment. Inappropriate collection or disposal of pharmaceutical waste is a crime against nature. Other living organisms have equal right to live in this world, and we have to respect this in any conditions and circumstances.

Although, several surveys have noted that the effectiveness of these collection systems and their results varies widely across Member States¹¹ and ¹². For example, in the Netherlands, where collection schemes have been running for several years, a study from 2013 found that almost 68% of the respondents returned their unused medicines to the

pharmacy or a hazardous waste collection point, 15% threw them in the bin and 7% flushed them down the toilet.

A study in the UK found that, of those interviewed, 2/3rd discarded unused medicines in household waste, with the remainder either returning them to a pharmacist (21.8%) or flushing them into the sink or toilet (11.5%). As a last example, a survey in Latvia (fourth poorest European country) found that 41% of the respondents discarded without knowing their environmental risk. Figure 1- Examples of communication activities in different European Member States (Spain - website; France - social media; Luxembourg - leaflet; Croatia - poster; News piece - Ireland) unused medicines in the rubbish, while 15% flushed them down the toilet and only 7% returned them to pharmacies or hazardous waste collection sites.

In many Member States, people seem to be inactive about what they should do with expired or unused medicines and are not aware that they can take unused drugs to collection facilities. Awareness programs should be conducted in such states. The inactivity of citizens seems to influence the quantities of medicines put into collection schemes in Europe. But generally the overall message for European citizens is patchy, unclear and lacking in many countries. Currently, it is not always clear for customers how they should and could dispose unused pharmaceuticals effectively and there is lack of knowledge on the environmental risk of incorrect disposal. Additional steps are needed to influence and change behaviour amongst the population.

Consistent guidelines and advertisements in televisions, across Europe could contribute to a decrease in pharmaceutical residues in the environment. Different parameters have been used at national and international level to promote awareness of proper disposal schemes for unused pharmaceuticals and to raise the problems of pharmaceuticals in the environment (Figure 1). Most of the parameters are based on communication activities towards the general public, such as ads or media inserts, websites, brochures and posters, but have also involved training camps for doctors and pharmacists who can then provide information to patients [3].

The Health Care without Harm (HCWH) helps the implementation of collection strategies for unused medicines is one of the measures, HCWH in Europe dramatically reduces the impact of pharmaceuticals in the environment, together with promoting "green pharmacy", improving prescribing practices, and supporting the adaptation of effective wastewater treatment methods. For this report, HCWH Europe conducted a survey of the general public's approach to disposal of unwanted medicines, in selected countries, to understand the current behaviour of citizens regarding collection schemes. This survey tries to understand consumer behaviour in handling household pharmaceutical waste (expired and unused medicines).

One-to-one interviews were conducted in the city centres of the capital cities of six European countries: Belgium, Hungary, Italy, Lithuania, Portugal and the United Kingdom. The countries were selected taking into consideration about the types of collection systems for unused pharmaceuticals implemented at national, regional

or local level. During interviews very few people participate and only problem highlighted in this is related to educational gaps that a educated person follows the instruction by pharmaceutical waste collection systems. Data present in this report do not represent the whole population.

For every country, at least one surveyor was selected to conduct the interviews. All interviewers participated in a training session that mainly focused on how to perform and document the interviews. The interviews took place during the first week of 08/ 2013; in each city approximately 100 people were interviewed. The target group of the survey was native speakers who were residents in the country where the interviews took place and aged 18 years or older. The interviewees were spread evenly across different ages. Surveyors approached people directly on the street in their native language. At the beginning of each interview, the surveyors explained the goal of the project. Each interviewee was given a study code and the surveyor completed the interview form. No any personal data were collected.

The respondents were asked several questions that covered demographic characteristics (age group and sex), behaviour and opinions in relation to the proper disposal of unused drugs, the collection system implemented in their country and the level of awareness of the problem of pharmaceuticals in the environment. Closed and open-ended questions (Question that simply reply by saying yes or no) were used. The open-ended questions were used to try to obtain truthful answers and avoid people feeling pressed to give answers that they thought the surveyor might want to hear [4].

(B) REVIEW LITERATURE

Improper disposal has several possible consequences such as childhood poisoning, environmental pollution, a negative impact on wildlife, and antibiotic resistance. Effectiveness of health care system is evaluated by measuring the drug wastage.

Most of Active Pharmaceutical compounds are polar compounds. Such API are called SMALL MOLECULES and are part of the compound called MICROPOLLUTANTS because they are often found in the mg or nag range in the aquatic environment. Pharmaceuticals for human use have serious effect on the environment due to micro pollutants released into the nature with well-known example i.e.-

1. ESTROGEN and their effects on fish.
2. DICLOFENAC and their effect on vultures.

The importance of pharmaceutical waste in the environment increased after the DICLOFENAC DISASTER. Vulture population reduced after they fed on cattle treated with diclofenac.

The FEMINIZATION (shift in gender role and sex role in society) DEMASCULISATION (remove testicles of a male animal) of male fish are attributed estrogens which are formed as by-product in industries.

A survey conducted in the U.K. revealed unhealthy practices of 400 households where they disposed

unused and expired pharmaceuticals either as household waste or via the sink or toilet. Unused prescription drugs are sometimes brought to PILL PARTIES (also called PHARM or SKITTLES parties) where adolescents experiment with pills they select from the pool of medication brought by partygoers. With opioids, in particular, some product contains enough API in a single tablet to cause death in a

patient, especially if mixed with other sedatives or alcohols. To minimize the adverse impact of pharmaceutical compounds on the environment as well as the danger consequences like abuse, addiction and also death for these unused and expired medicines need to be addressed.

WHAT IS A PHARM PARTY?

when a group of teenagers get together to **share drugs** and have a good time

Fig (a) Showing meaning of a PHARM PARTIES

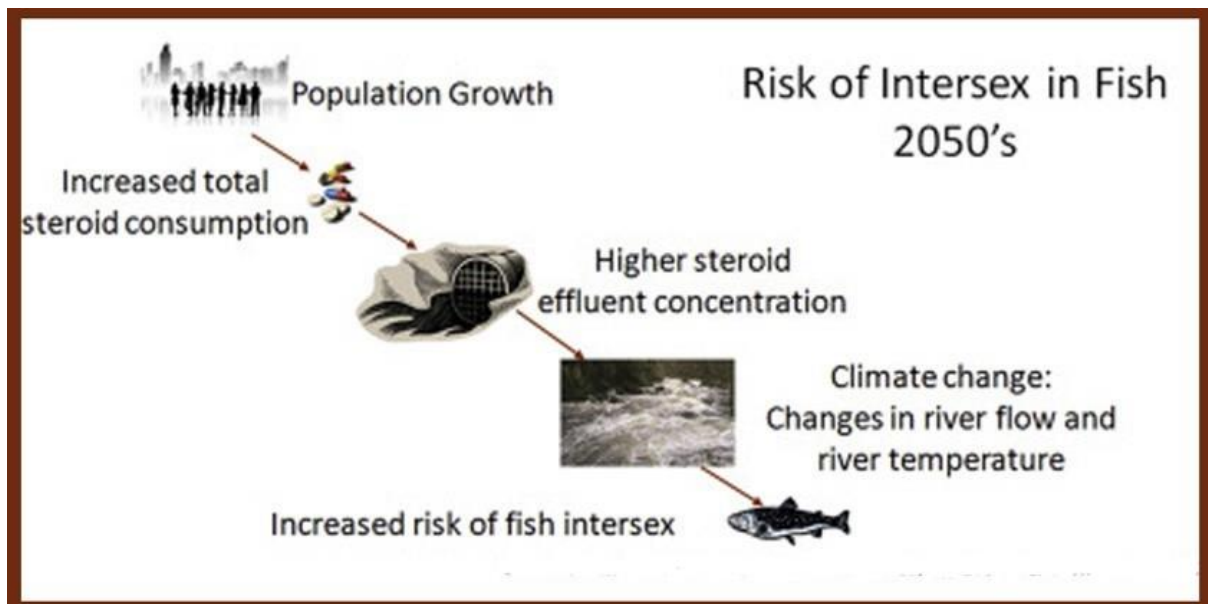


Fig (b) Showing Increased Risk of Fish Intersex Due to increased Steroid Consumption.

HIGHLIGHTS

- Pharmaceutical waste disposal practices of unused and expired pharmaceuticals among general public in Kabul, Afghanistan
- We survey the knowledge and practices towards unused and expired pharmaceutical among general public
- Rectification of future medication waste disposal among families
- Giving information on safe and effective disposal of drugs.

- Data generated during these surveys helps the policymaker to take firm steps to encourage standard pharmaceutical waste management.
- Training camps for doctors in order to prescribe medicines according to the conditions not for business purposes.

Gaps in medication during drugs therapies can also cause storage of left over medicines at home. According to WHO about 50% of patients fail to take medicine correctly [8]. This block medication can save thousands lives before their expiration but people remain active for the submission of these drugs to their near pharmacy centers. [9].

When there is a matter of unused and expired medication storage, patients and family members must require clear

guidance about its disposal [5]. The presence of unused and expired medications in boxes and cupboards is a potential threat and can be harmful to humans, environment and wildlife [10, 12]. Specifically, the presence of discarded medicines in water and drinking water is a serious and lethal issue that has gained national and international attention with the public, lawmakers, and regulators [13].

For instance, non-steroidal anti-inflammatory drug (NSAID) diclofenac has been shown to induce renal failure in vultures. This effect on vultures due to intake of cattle meats that were treated with diclofenac, due to which a huge population of vultures are swiped out from India. This disaster termed as DICOFENAC DISASTER. The ingestion of carrion from cattle treated with diclofenac responsible for this mass elimination of vultures [14]. The improper disposal of unused and expired medication lethal for the environment for example in the USA many medicines such as acetaminophen, verapamil, and estradiol are found in waterways. [15]. The trace levels of ethinyl estradiol, in water responsible for, impairs sexual development and the feminization of fish [16]. Evidence shows that the availability of antibiotics in water may lead to antibiotic resistance [17] and in long term exposures may cause genetic effects in humans and marine life [13].

In Kabul, Afghanistan, the waste product of a mass vaccination programme of 1.6 million against polio in 10/2008 were discarded in the local municipal waste, causing infectious injury to individuals searching waste in dump sites for reusable items. Other Pharmaceutical waste have been found lying in the open land-fills near hospitals in urban areas [18]. Similarly, it has been found that more than 60 or more hospitals in Kabul do not have incineration facility (The destruction of something, especially waste material, by burning) or access to other important Health Care Waste Management (HCWM) equipments [19,20].

The Health care wastes include all the waste generated by health-care establishments, research facilities, and laboratories [21]. Pharmaceutical waste is one of the important constituent of the HCW, which contains medicines or no longer needed, contaminated items, or pharmaceuticals, which need effective and systematic disposal techniques to get rid of its hazardous effects.

WHO's European Centre for Environment and Health in France, construct an international working group to formulate a practical guide, addressing mainly the problems of HCWM in developing countries [22]. Some programs such as Disposal of Unwanted Medication Properly (DUMP) campaign was established in New Zealand [23] and in Canada ENVIRx disposal program was started. [24].

Yet some developing countries do not have official state guidelines or protocols for the proper disposal of unwanted and unused medications [25, 27]. In Afghanistan, the National Medicine Policy (NMP) emphasizes (forcely) the disposal of expired medicines by distributing one percent of the cost of all medicines to be provided in Afghanistan, for pharmaceutical product waste management activities.

The General Directorate of Pharmaceutical Affairs (GDPA) was held responsible for the effective monitoring and evaluation of drugs use and their waste management plan implementation throughout the nation [28]. Disposal of pharmaceutical wastes are no uniform in different portions of countries which shows the current disposal system is in not effective one. To overcome these inabilities of the disposal system the Ministry of Public Health (MoPH) reconstruct Comprehensive Healthcare Waste Management Plan (HCWMP) for the Enhancement of proper medical waste management, for Health Action in Transition (SEHAT) Project [29] for the handling of pharmaceuticals waste requiring destruction [30]. But these steps in management of pharmaceutical look handicaps because these projects lack proper transportation facilities in order to collect expired or unused drugs from different locations of country [30].

In developing countries like Afghanistan, the false management of HCW is due to lack of facilities, application of legislative policies and control [31]. Thus strict and strong policies should be applicable dealing with HCW disposal; especially in developing economies is needed [9]. In addition, public awareness programs and different practical approaches are mandatory to dispose unused medications.

No study has so far been conducted regarding malpractice of drug use and disposal practices of unused and expired pharmaceuticals among the general public in Kabul. In Afghanistan, availability of data regarding disposal of pharmaceutical waste is zero, knowledge and practices towards expired medication in developing countries not up to the mark or standard. This study was therefore planned with the goal to report the current conditions and attitudes of general citizens towards disposal of unused and expired pharmaceuticals.

METHODS:

Study design:

This was a detail of descriptive, cross-sectional survey, conducted through face-to-face interviews using pre-validated structured questionnaire. The study was conducted in Kabul between 01 to 03/2016.

The study was conducted among different ages and sex, which included students, public and private sector employees, storekeepers and population from other walks of life, above the age of 18 years, who were local residents of Kabul, regardless of cast or employment designation.

Sampling/sample size

A non-probability sampling technique in which researcher selects samples based on his judgments, (convenience method) was employed to reach to the representative population easily in districts of Kabul Afghanistan.

The data collectors were trained perfectly and able to explain the purpose of the study to their potential respondents prior to administering the survey questionnaire. Participation in survey was voluntary not a

type of forced survey. The questionnaire was provided in two languages (Dari and English) to make the survey more effective one. Face-to-face interview technique was used by filling up questionnaires. Use of native or local languages during surveys increases the content of information's which seems to very helpful in order to collect precious data of interest.

Data analysis

Collected questionnaires were double-checked for more accuracy and then the collected data were feed into an Excel spreadsheet Dataset. Then the processed data was transferred to Statistical Package for Social Science (SPSS) version 23(IBM software) for analysis. Descriptive statistics (descriptive, crosstab and chi-square test) were used.

Ethical considerations

Survey was conducted in consent of participants. It was a voluntary type survey that survey do not try to affect their rights in any case. Identity and personal information of candidates kept confidential. Main motive of survey is to

highlight the awareness of citizens regarding their surrounding which undergo contamination due to malpractices of drugs disposal and dumping.

RESULTS

Demographic data

In this survey the about 301 individuals agreed to participate in the study and rest of them declined to be the part of this survey. Participant's response rate was found to be 100% in which, 221 (73.4%) were men and 80 (26.6%) were women. Maximum (104; 34.6%) respondents were aged 33 years and above. One hundred and sixteen (38.6%) respondents had up to secondary education, 163 (54.2%) were complete their university graduation and 22 (7.3%) were illiterate (not able to read and write) [Table 1].

The Cronbach's alpha (coefficient alpha) which is a estimate of reliability for all items was 0.70, which means that 70% of the variance in the scores is reliable variance, therefore there is 30% is error variance

Demographics and knowledge about procuring medicines

Variables and categories	Number of responses (%)	
Gender		
Men	221	73.4%
Women	80	26.6%
Age		
18-24	103	34.2%
25-31	94	31.2%
32 – above	104	34.6%
Marital Status		
Single	160	53.2%
Married	141	46.8%
Level of Education		
Illiterate	22	7.3%
Primary	45	15%
Secondary	71	23.6%
University	163	54.2%
Ways of Procuring Medicines		
Purchased on prescription	251	83.4%
Purchased over the counter	44	14.6%
Received from friend/ colleague	3	1%
Purchase based upon the advice of a relative or friend	3	1%
Classes of medicine used		
NSAIDs	61	20.3%
Antibiotic	140	46.5%
Anti-hypertensive	42	14%
Anti-diabetic	23	7.6%
Other	35	11.6%
Do you check expiry date of the medicines before procuring		
Yes	290	97%
No	6	1.7%
Don't know	5	1.3%

Knowledge about procuring medicines

Regarding knowledge regarding procurement of medicines, 251 (83.4%) respondents purchased medicines on the basis prescriptions and 44 (14.6%) purchased medicine over the counter these are the population mainly practices self medication and bypass the medical persons. Most commonly purchased medicines were antibiotics ($n = 140$;

46.5%), NSAIDs ($n = 61$, 20.3%), anti-hypertensive ($n = 42$; 14%), and anti-diabetic ($n = 23$, 7.6%). The majority of people ($n = 292$; 97%) checked the expiry date of medicines, prior to purchase [Table 1]. In addition, it was observed that 142 university graduates procured medicines on prescription. Similarly, 159 university graduates checked medicine expiry date before purchase [Fig. 1].

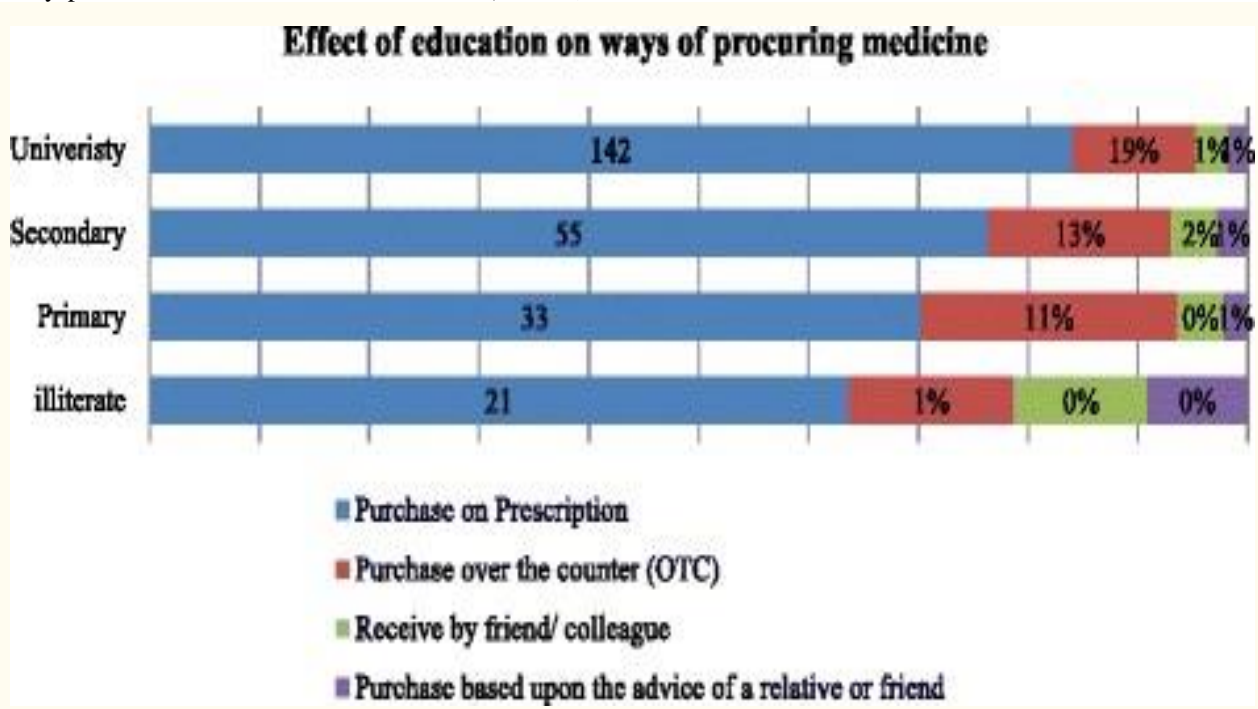


Fig (c) Effect of education on ways of procuring medicine

Table 2 shows the awareness regarding expire date among all respondent

The majority (159/301) of university graduates checked the expiry date of any medicine prior to its procurement. Table 2. Participant’s views about checking expiry date of the medicines before procuring

	Do you check expiry date of the medicines before procuring		
	Yes	No	Don't know
Illiterate	18	2	2
Primary	42	3	0
Secondary	71	0	0
University	158	3	2
Total	292	5	4

University graduates ($n = 158$) said that improper disposal of unused and expired pharmaceuticals can affect both the environment and health; it is a potential risk to nature (Table 3).

Table 3 Effect of Education on attitudes towards the effects of improper disposal of unused and expired medicines on environment and health

Level of Education	Yes	Don't Know	Total
Illiterate	22	0	22
Primary	43	2	45
Secondary	69	2	71
University	158	5	163
Total	290	11	301

Practices and attitudes towards unused and expired medication disposal.

Table 4 represents the responses of participants regarding the items intended to measure public practices and attitudes towards unused and expired medication disposal and its environmental impact.

When we asked the participants about the blocked stock of medicines present in their home maximum of them replied positively ($n = 287$; 95.3%). This blocked stock of drugs not in use and after some time expired, and undergoes improper disposal practices by the user of drug which have direct impact on the nature. A small majority (52.2%) of the interviewed respondents block the unused medicines at home until expired.

Maximum number of the respondents ($n = 234$; 77.7%) were throwing the expired medicine in household trash without knowing their impact on living organisms and nature. Six out of 10 (60.8%) of the respondents directly fingered towards the government; that the government was responsible to create awareness and awareness programs for proper disposal of unused and expired medicines.

Maximum number ($n = 294$; 98%) of respondents said that improper disposal of unused or expired drugs directly into nature or near water resources not a healthy practice. A large portion of respondents said that they have unused medicines in their homes, offices and these medicines were antibiotics in most cases this also highlight the self medication in people which were responsible for resistance.

Table 4

Respondents' practices and attitudes concerning unused and expired medication disposal.

Questions		N	%
Did any quantity of purchase medicine remain unused at your home?	Yes	286	95.3
	No	15	4.7
What do you do with the unused medicines?	Throw away in household garbage	42	14.3
	Donate to hospital	30	9.6
	Give to friends or relatives	5	1.3
	Return to medical stores	64	21.3
	Keep at home until expired	156	52.2
	Flush unused medications in toilet or sink	4	1.3
What do you do with the expired medicines?	Throw away in household garbage	233	77.7
	Flush expired medications in toilet or sink	37	12
	Give to friends or relatives	3	1.3
	Return to medical store	23	7.3
	Don't know	5	1.7
Who is responsible to create awareness for proper disposal of unused and expired medicines?	Government	182	60.8
	Pharmaceutical Industries	37	12
	Public	16	5.6
	Pharmacist	66	21.6
Improper disposal of unused and expired medicines can affect the environment and health.	Yes	294	98
	Don't Know	7	2

Discussion Today pharmaceuticals waste management and disposal become a hot topic grabbing attention at national or international level because it has been realized that improper use of drugs and their direct impact on nature not reversible one and can contaminate the environment, a drug

when come in contact of water it simply dissolve because maximum drugs we are using in different medical conditions are water soluble due which contamination of water is more frequent by drugs which have direct impact on the living organisms specially aquatic. A study was conducted in different countries regarding disposal of

drugs, which clears that a developing countries do not have proper resources and facilities to overcome this problem, even these countries paying zero attention towards this threat, but picture look more effective in developed countries that they have strict policies regarding the disposal of pharmaceutical wastes.

The Table 1 shows that maximum of the victims purchased drugs on prescription, which shows effective medicine purchase practices. Results from unused medication collection program in California justified that more than 51% of OTC (over the counter drugs) drugs were trash unused, compared to 46% of prescription medicines [13]. Maximum amount (50%) of drugs that was procured by respondents were antibiotics which was a alarm for them and medical council, in maximum cases people uses these antibiotics in flipping manner which simply leads to resistance development. About 40% or less procured drug was NSAID which is quite common because these drugs simply work against pain. Education plays a vital role in order to understand about the risk potential of drugs which was justified by the surveys.

Taking excess dose of drugs was more common in uneducated one; they mainly undergo self medication which increases the chances of overdosing and even lethal damage to vital organs of body. But graduated persons always follow the instruction regarding the use of drugs and do not undergo malpractices regarding use of drugs for treatment purposes [37].

Interestingly, in this survey nearly all candidates checked the expiry date of medicine, before its purchase, while in another hand; in the Indian state of Gujarat many were not aware of the expiry date of medicines they simply use them without any worry [38]. It is very important is to purchase or use of any medicine, the expiry date must be checked, and otherwise it may lead to serious harmful effects [38].

The actual status of study shows that efforts towards disposal of unused and expired pharmaceutical were optimal but more than 95% of the candidates surveyed had left drugs at home and half of the interviewed candidates kept the unused medicines at home until they expired, which is a pool of potential health threat [39]. Borrowing and sharing of drugs is known to be associated with several risk factors such as skittle parties or pharm parties in which teenagers collect drugs and enjoy hallucination due to these drugs which sometimes lead to death and multiple, chronic disease [40], But such behaviour or attitude observed rarely among candidates which is good. In maximum of survey candidates accepted, that they thrown away the expired medicines in the household garbage which highlights the malpractice [27]. In Bussan city of Korea wife's disposed unused or expired medications using the standard garbage bag which again a malpractice [41].

It was believed that best way to discard unused or expired drugs is to flush through sinks or toilets WHO itself issued a

list of drugs which is safe to discard through toilets or sinks its look odd and again a mal practice Previously it was believed that proper method of unused or expired medications disposal was to flush down the toilet / drain, as opposed to discarding them in the trash, where animals or humans have to face the consequences [42]. About 10% of the candidates flushed the expired drugs down the toilet or sink, which are similar to the malpractices followed by the citizens in Kuwait, UK and USA [26, 43], where it is the best practice for disposal of liquid medications [27].

Very few candidates return the unused and expired drugs to medical stores, which is similar to people practice in the USA and Malaysia [36, 43]. In developing countries strict and strong measures leads to fruit full results such effective practices regarding disposal of unused or expired drugs plays a vital role in order to reduce the contamination rates of drugs in our environment. Pharmaceutical wastes should be transformed rather than dumping or disposing because such drugs need to detoxify properly before introducing in nature [32, 44].

Effective guidelines for disposal of medical in different countries lacking due to flexibility of constitution specially in India; development of nation at different levels is important but this have a negative effect on our health and surroundings which should be considered and rectify as soon as possible; development of appropriate method for disposal of pharmaceutical wastes should needed for ensuring minimal impact on nature. In USA Nebraska medication society suggested some effective ways to deal with medical wastes; which includes tempered boxes use to collect unused or expired drugs from people and further return back to nearest pharmacy center for proper processing. But disposal of unused or expired drugs is not a possible solution because dumping increases the risk of soil contamination; which may or may not leads to water contamination. Best way to get rid of such risk is to reuse medicines by developing effective extraction techniques as I do in my work where I simply convert a expired aspirin tablets into phenol ad methyl salicylate which are only recommended to use on non living stocks. [44].

Some developed countries put a bench mark regarding returning medicines to health facilities such as Sweden and Korea; this represents that the community aware regarding the potential risk of these unused or expired drugs on their surroundings and resources [33, 41]. Such malpractices regarding the use and disposal of drugs should be rectified in developing countries; this is possible when government take strict action and draw such policies which also include fine and punishments according to the type of drugs undergo malpractice [32]. Unused or expired drugs Return Program or Take-back programs in Canada [45] and Meds Disposal in Europe [46, 47].

Lack of take –back program not possible to conduct in distance places; which should undergo replacement with proper disposal of prescribed drugs; with kitty litter,

sawdust etc. in plastic bag container and disposed in the trash [48]. Never dispose drugs with edible garbage because; ingestion by animals leads to serious problem. Proper disposal of expired drugs should be increased by awareness camps in community that guide people regarding proper disposal of medicinal wastes.

American pharmacist association recommended discarding drug with non edible wastes to prevent direct interaction with living organisms [49]. Health care organisation recommended five ways or methods to dispose expired or unused drugs, First one is to cross the name of patients followed by removal all labels of drug containers; mix the drug contents in water with kitty litter, spices, sawdust in order to make stinky which prevent ingestion by living organisms; use a opaque plastic bags to dispose drugs which further proper sealed and wrapped with packaging tape. Precautionary, the drugs should not be mixed with edible items because animals could accidentally ingest them. Finally; discard container in the trash [50].

Above mentioned methods to discard medicines tedious or timing consuming, the effective and better option for the safe disposal of pharmaceutical waste is incineration (burn them in fire) which requires third party interference for the collection of unwanted medicines [51]. For example, in Australia medical services runs a program in which expired or unused drugs are collected by these agencies and undergo incineration under high temperatures this method of drug disposal is approved by USA drug authorities [27].

Knowledge regarding effective disposal of unused or expired drugs should be appropriate or accurate there is no space for mistakes because we are dealing with drugs not with garbage. In many countries pharmacy school provides good exposure for the growing pharmacists regarding disposal of medical wastes [52]. In Taiwan, a booklet was published by pharmacy council which includes the use of drugs and storage conditions, such publication plays vital role for the consumers to understand the use or

abuse of drugs and also clears about their potential impact on nature [53].

Government of some countries provide free medication to patients which leads to increase in medical wastes; government have to focus on this because excess drugs have lethal effects in nature e.g. extinction of species. Drugs should be dispensed according to conditions of diseases; but now a day's dispensing of drugs in greater numbers by pharmacists become a integral part of pharma business which highlight a malpractice [54].

The study results suggest that government, pharmacist, and pharmaceutical industry are responsible to create awareness, which is consistent with the suggestions made by others [36].

Proper education regarding drug use and disposal is important in every part of world and it is only possible when educational departments of different countries introduce a particular subject of pharmacy which purely deal with use and disposal of unused or expired drugs in community [55].

CONCLUSION

Nature provides human beings everything but human always abuse it; in eyes of nature human is also a living organism; but human create artificial world which is full of diseases and infection which is mainly due to improper disposal of waste. Now it's time to wake up and do some effective work regarding disposal of medical wastes. In my opinion disposal not a permanent solution for this we have create such methods or techniques through which we can convert expired or unused drugs into useful chemicals. I formulated a floor cleaning agent which is termed as expirophenol, derived from expired aspirin tablets. As in case of aspirin we can transform any expired drug in different useful chemical.

ABBREVIATIONS

DUMP	Disposal of unwanted medication properly
GDPA	General Directorate of Pharmaceutical Affairs
HCWM	Health Care Waste Management
HCWMP	Comprehensive Healthcare Waste Management Plan
NMP	National Medicine Policy
SEHAT	System Enhancement for Health Action in Transition

(C) GAP GENERATION

Extraction of active pharmaceutical ingredients is not a simple or easy one because for extraction of API we need to do solubility studies of different components present in

the dosage forms including active pharmaceutical ingredients.

Active Pharmaceutical Ingredients isolated from expired drugs have decreased therapeutic index and according to drug authorities not administered to the patients for treatment of diseases. Although expired drugs have

decreased therapeutic activity and nothing else. But we can extract these drugs and use this extracted portion of Active pharmaceutical ingredients in laboratories for study purposes, in plants, in animals (Tropical fish) and many more are still waiting to discover.

Extraction procedures of API should be ecofriendly and effective one. Some extraction procedures are expensive

due to the use of expensive solvents, therefore we can add up solvent recovery techniques in our going on extraction procedures to minimize the solvent loss.

Some API loss their activity when they are treated with different organic compounds so it should be considered during extraction (about their interaction between different solvent systems).

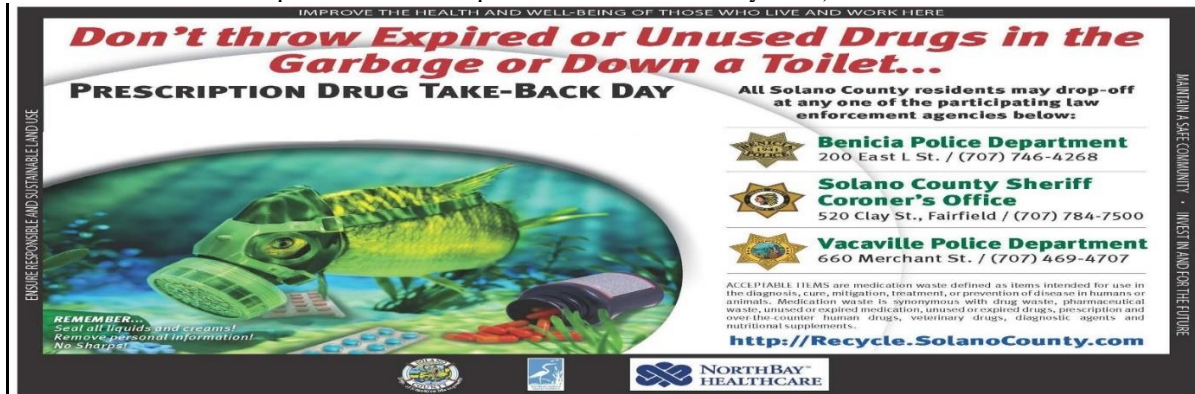


Fig (d) Showing program conducted by U.S. County Sheriff for prevention of mal practice of expired drugs and unused drugs in community.



Fig (e) Showing proper way to prevent abuse of prescribed medicines.

	UAE	MAE	SFE	ASE
Name	Ultrasound-assisted extraction	Microwave assisted extraction	Supercritical fluid extraction	Accelerated solvent extraction
Brief description	Sample is immersed in solvent and submitted to ultrasound using a US probe or US bath	Sample is immersed in solvent and submitted to microwave energy	Sample is placed in a high pressure vessel and crossed continuously by the supercritical fluid	Sample is heated by a conventional oven and crossed by the extraction solvent under pressure
Extraction time	10-60 min	3-30 min	10-60 min	10-20 min
Sample size	1-30 g	1-10 g	1-5 g	1-30 g
Solvent use	50-200 ml	10-40 ml	2-5 ml (solid trap)30-60 ml (liquid trap)	15-60 ml
Investment	Low	Moderate	High	High
Advantages	Easy to use	Rapid Easy to handle Moderate solvent consumption	Rapid Low solvent consumption Concentration of the extract No filtration necessary Possible high selectivity	Rapid No filtration necessary Low solvent consumption
Drawbacks	Large amount of solvent consumption Filtration step required	Extraction solvent must absorb microwave energy Filtration step required	Many parameters to optimize	Possible degradation of thermolabile analytes

Fig (f) Showing Disadvantages and Advantages of Different Extraction Techniques.

NOTE: With the advancement in the extraction techniques consumption of expensive solvents used during extraction procedures decreases and also there is decrease in extraction time.

But some of these extraction techniques are quite expensive and not easy to afford. Selection of extraction procedures mainly depend upon the type of API we want extract. We know that use of expired drugs are not recommended for any type of treatments but we can use these expired drugs for other purposes that make these expired drugs useful and this way we support our nature and other living organisms.

As we know that a single drug have many other useful effects beside their therapeutic values, all we want to do that is explore it.

(D) AIM AND OBJECTIVE

My aim is to develop an extraction technique especially for extraction of API (Active Pharmaceutical Ingredients) from

expired Pharmaceutical Dosage forms which have negative effect on our surroundings and living organisms.

Such extracted active pharmaceutical ingredients utilize in various educational organizations for study purpose only, this also increase the effective and smart utilization of medical waste materials and this way we can also promotes the ecofriendly synthesis and consumption of drugs in our society.

We know that the medical waste has lethal effect on the living organisms that are living around us. By extraction procedures we can make this medical waste into a useful and productive matter that can further utilizes in various activities for human welfare.

My main focus is to reduce medical waste by extraction of active moieties from them, Different dosage forms of drugs required different extraction techniques with little modification in them, these modifications help to make our extraction technique ecofriendly and economical one.

Extract	Mass of starting Anacin tablet	Mass of isolated solid product	% Yield	Melting point
Caffeine	0.52g	0.02g		240°C
Aspirin	0.52g	2.5g		142°C

Fig (g) Showing mass of isolated product from expired ANACIN tablets.

We can isolate any active moiety from dosage form by using suitable solvent and effective work up in laboratory. For better results we should proceed in sophisticated laboratories. Most suitable solvent system for isolation ASPIRIN is acetone. And we can also recover whole

quantity of used acetone during extraction procedure by modification of extraction assembly by attaching a condensation apparatus that help to condense the vapours of solvent during extraction process.

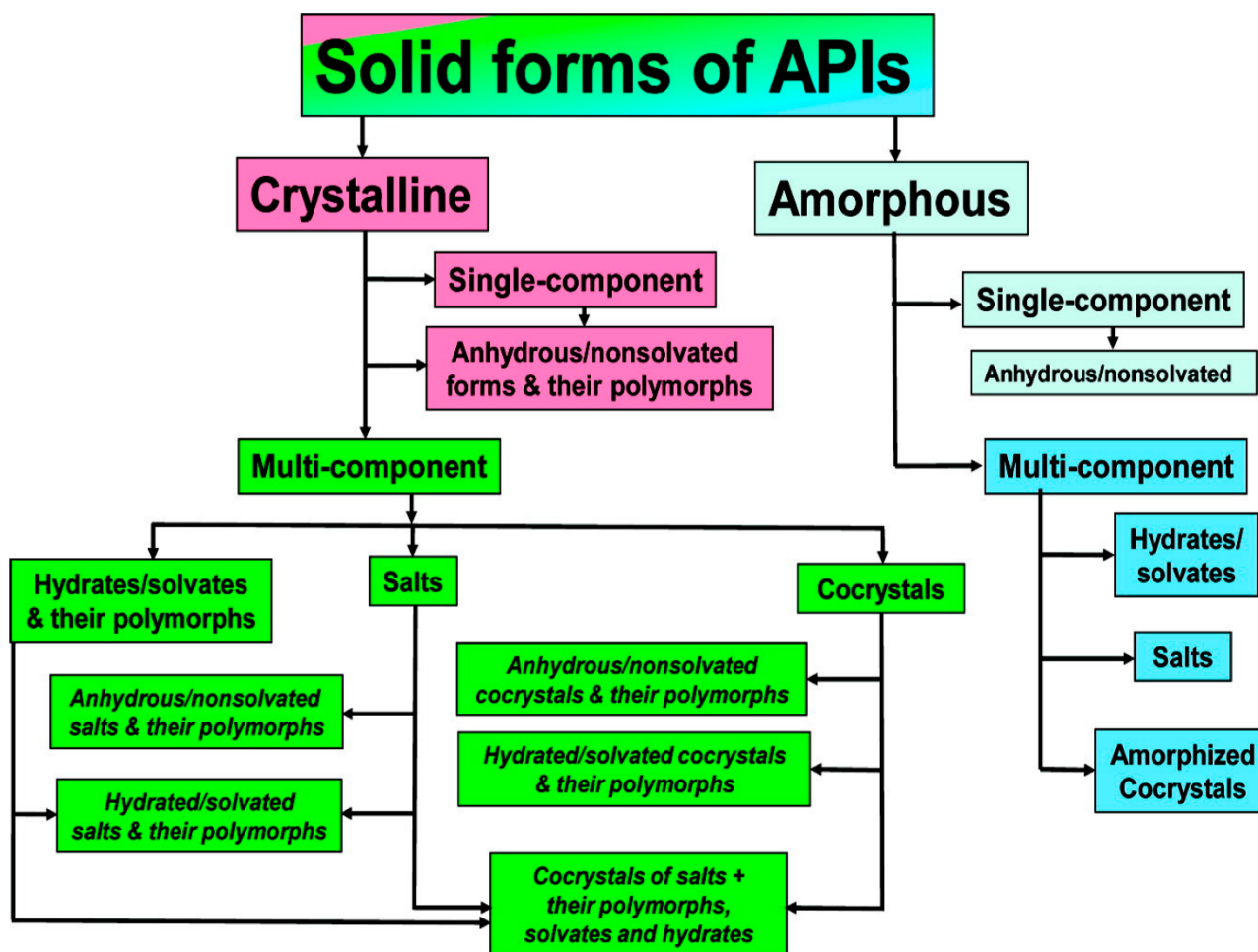
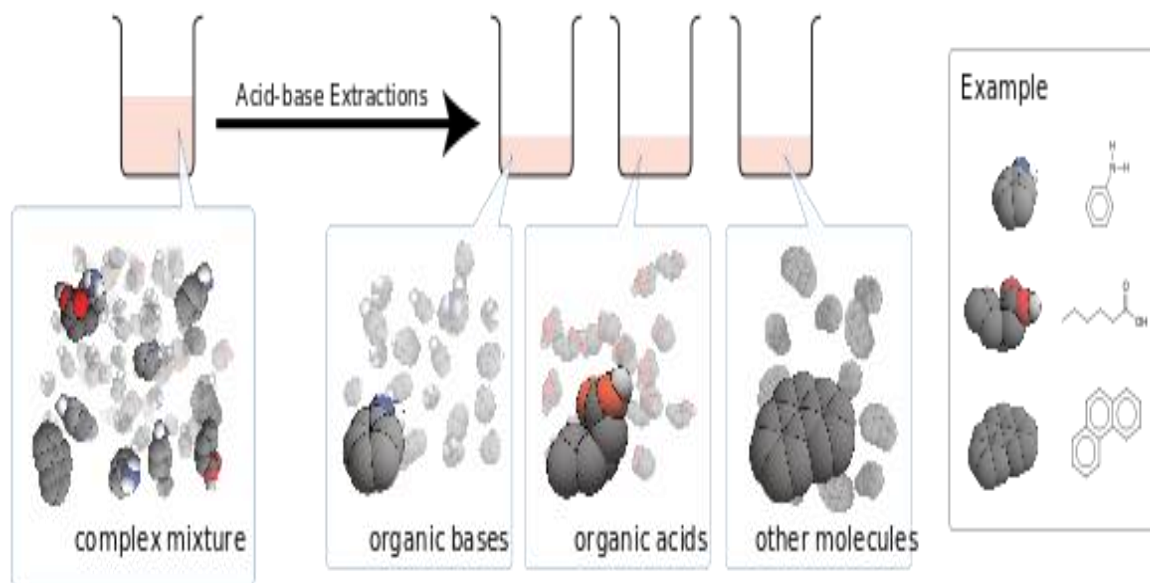


Fig (h) Showing different forms of API (ACTIVE PHARMACEUTICAL AENTS).

(E) WORK DONE

ASPIRIN is the well-known brand name, but the common chemical name is ACETYLSALICYLIC ACID, or ASA for short. Extracting the ingredient from pills can be a fun exercise on its own, but I actually plan to use the ASA in a

pretty lengthy synthesis. My goal is to convert Aspirin to Phenol and Tylenol.

After its extraction from the expired pills of ASPIRIN. Conversion of aspirin into Tylenol and Phenol is possible because Aspirin and Tylenol both have Phenol as a common precursor.



Fig (i) Showing structure of METHYL SALICYLATE and PHENOL

The plan is to sequentially degrade the Aspirin back down to phenol, and from there it will be built up to make Tylenol. I am really interested to see what my final yield is, and how efficient this whole process will be. For extraction of aspirin from expired tablets or pills, we only need two main supplies. Acetone and Aspirin. 400ml Acetone and 100 aspirin pills of 500mg.

My main motive is to create such a method through which we can utilize expired drugs in our educational institutes and school for educational purposes only, not treated as a drug but a drug to study the reactions and synthesis of different compounds. This approach helps us to utilize maximum quantity of expired drugs in our surrounding and support the nature. Transformation of expired drug is only possible solution to get rid of unused or expired drugs around us.

PROCEDURE:

- First crush the expired aspirin tablets with the help of grinder for better results. Keep grinding until all tablets fully powdered.
- After grinding pour the contents into the large size beaker.
- Now pour 200ml of acetone to the powdered aspirin tablets.
- Now heat the reaction mixture over the hot plate with magnetic stirrer the main aim here to heat the reaction mixture to a point where acetone starts boiling.
- Heat the contents for about 5 minutes.
- The next thing we want to do is carry out a filtration to separate the acetone from the undissolved stuff.
- I filtered it immediately after taking off the hot plate, but I think the best thing to do is to let the solids settle out a little bit.
- When doing a hot filtration, most of the time you want to do gravity filtration because using a vacuum can cause some problems.
- Because I included the solids, the vacuum had to pull harder to get the acetone through and a stronger vacuum develop in the flask below.
- With a stronger vacuum going, a lot more acetone evaporated, and because we are working with a saturated solution, a bunch of ASA (Aspirin) started to

precipitate out. You can actually see the moment here where the problem occurred.

- Everything seems to be going more or less okay, but very quickly, a lot of aspirin starts to crystallize out.
- In the flask below, this really is not much of a problem, but an issue arises for the filter funnel.
- The narrow stem in the filter funnel gets pretty much completely blocked, and filtration comes to a stop.
- I tried fixing the things by removing the blockage and by diluting things with some fresh acetone, but it did not really seem to work.
- The only way to fix things was to do a proper washing with acetone.
- The total volume of acetone here is about a hundred and fifty milliliters (150 ml).
- This step here was only supposed to be done with about a hundred ml of acetone, but because of the problems we ran into, and the extra washing I needed to do, the total volume was raised a little bit.
- The contents of the beaker and whatever trapped in the funnel was washed one last time with fifteen ml of hot acetone.
- After these three consecutive washing steps there should be little to no aspirin left over.
- The stuff that remains in the beaker and the filter is mostly filler and it can be thrown out.
- This solution or filtrate is pink due to the use of dye in the formulation of tablets.
- Even after purification, the ASA (Aspirin) might be a little bit pink.
- To avoid this, it's best to use a brand that does not include any dyes in their pills.
- At the bottom of the flask it looks like there is a lot of crystallized ASA (Aspirin). With just a little bit of swirling though, everything quickly re-dissolves.
- Now we set things up for a quick distillation, and I forgot to add a stir bar so I just chuck one in.
- So what we want to do now is distill off as much acetone as possible and recover the acetylsalicylic acid.

- In the video made by chemplayer, the acetone was simply just evaporated in dish.
- That's completely viable method, but I want to recover the acetone, which is why I am doing distillation.
- With the heating and stirring turned on, we slowly distill of the acetone.
- When we left with a white cake, and at this point the temperature should be turned down.
- The acetone recovered is not exactly super pure, so I would only keep it for rough washings.
- When I go to break things up using a spatula, it's pretty clear that there is quite a bit of acetone still left over.
- This can be slowly evaporated off at low heat, or we can use a vacuum.
- I already dismantled and cleaned up the distillation apparatus, so I opted to do it by vacuum.
- So I pull a vacuum on a flask and I quickly evaporate the acetone.
- One important thing to point out here is if you are using a typical pump, you needed to use a trap.
- After scrapping off most of the aspirin in round bottom flask transfer it to another container.
- If purity is not a huge concern, it can simply just be dried off and put into storage, but it was little pink still, so I decided to do recrystallization.
- When I went to transfer it to my two liter Erlenmeyer flask it was little annoying. Because there was a little bit acetone left, so the aspirin just kept clumping up.
- After a little bit annoyance, and shaking things around, I finally got the majority of it into the flask.
- Round bottom flasks washed with distilled water few times and transfer this into the two liters of flask.
- We are going to recrystallizing the ASA from cold water and we are gonna needed a lot of it, so the amount that we use in these washings steps is not a huge concern.
- After washing I topped it off to about one liter. Turned on the stirring and start heating.
- As the water heated up, more and more aspirin should dissolve.
- The aspirin is practically insoluble in cold water, but it is actually quite soluble in hot water.
- This allows us to dissolve our aspirin in a hot solution, and as it cools down, the solubility will slowly decrease, and the aspirin will slowly crystallize out.
- Once it cool downs to room temperature and everything is crystallized, I shake the flask to loosen things up.
- To separate off the nice and crystallized aspirin, I do a quick vacuum filtration.
- Because I have so much aspirin to filter off, I am going to have to do it in two separate batches.
- After washing two or three times, I keep the vacuum on for several minutes to get the crystals as dry as possible.
- To round bottom flask add 270ml of 14M NaOH which already contain 152g ACETYL SALICYLIC ACID.
- Solution dissolved properly with continuous stirring in order to ensure proper mixing of reaction mixture.
- Heat the round bottom flask until solution become yellow in color.
- Now proceed reflux in which sodium hydroxide convert ACETYL SALICYLIC ACID into disodium salicylate.
- After refluxing solution allow to cool down until it is easy to touch.
- This warm solution is then acidify by using 390ml HCL solution, this acid convert disodium salicylate into SALICYLIC ACID.
- For safety purpose HCL addition should done in small intervals not at once.
- After getting salicylic acid precipitates filter it.
- Wash the salicylic acid with excess of water in order to remove acid from it.
- SALICYLIC ACID is insoluble in water therefore loss should be minimal.
- Now dry it in oven and yield was found to be 112gm (90%).
- Further DECARBOXYLATION of salicylic acid gives phenol and reaction of salicylic acid with methanol yield crude METHYL SALICYLATE and further distillation of methyl salicylate gives WINTERGREEN which is a flavoring agent.

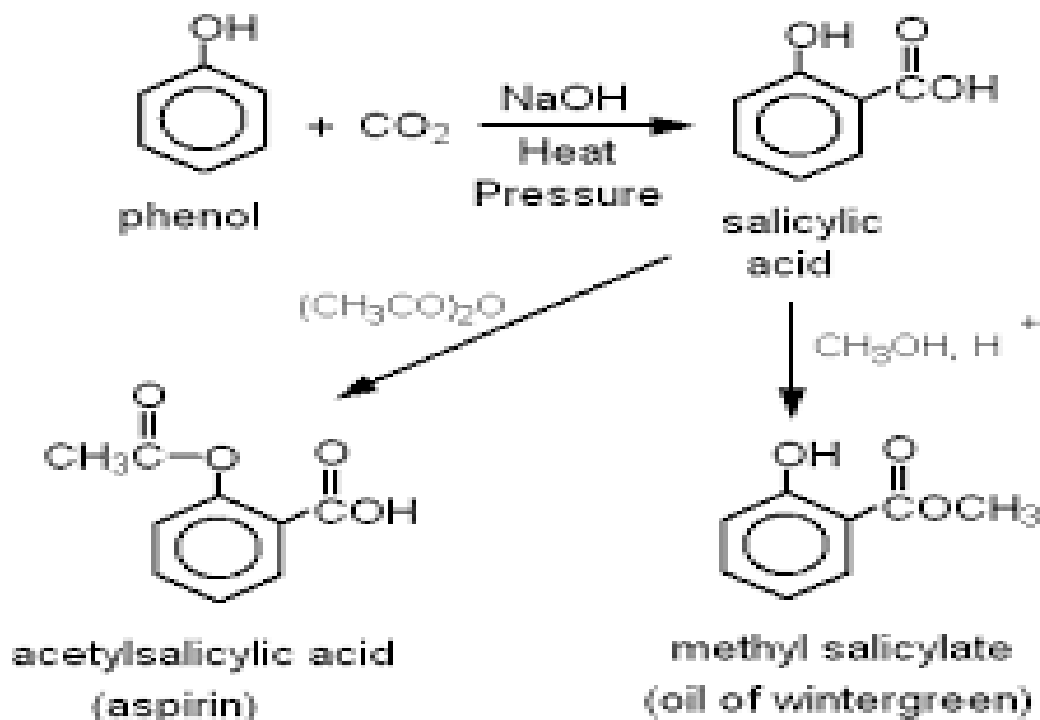


Fig (j) Showing conversion of phenol into salicylic acid and Oil of wintergreen.

(F) RESULT AND DISCUSSION

Conversion of expired aspirin into phenol and wintergreen is an effective way to get rid of expired aspirin tablets present around us; I choose aspirin tablets for my research work because aspirin is a well known drug and found in abundance. During literature I found that drugs that come in direct contact with nature have mixed responses some time beneficial and some time lethal. Aspirin is effective for inducing plant growth.

In majority of cases expired drugs belong to two main classes of drugs that are antibiotics and painkillers, main reason is self medication or OTC (over the counter drugs). Purpose of my research is to develop an effective technique to reuse expired aspirin tablets which have some potential risk to environment.

For justification of my work I will proceed for IR spectroscopy for functional group verification and NMR for structural identification.

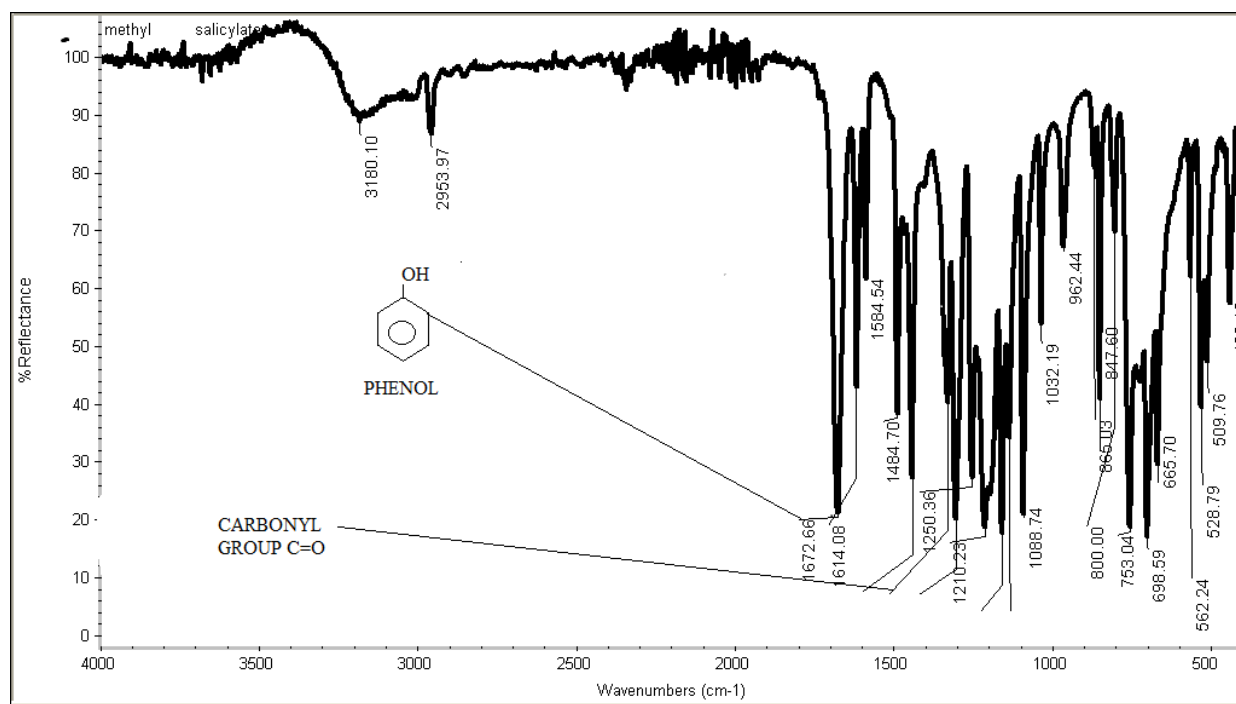


Fig (k) Showing IR Spectroscopy of METHYL SALICYLATE.

IR INTERPRETATION:

Infra red spectroscopy is a effective analytical tool for identification of functional groups present in unknown samples. Region in IR spectroscopy from 4000 cm^{-1} to 1600 cm^{-1} termed as DIAGNOSTIC REGION where peaks are clear or no multiple peaks observed this region particularly highlights the functional groups present in unknown samples.

Region from 1600 cm^{-1} to 400 cm^{-1} termed as FINGERPRINT REGION where we have multiple peaks; this region is quite difficult to study. Finger print region help to know about the molecule or compound we are dealing in IR spectroscopy. Region from 1600 cm^{-1} to 400 cm^{-1} represents STRETCHING VIBRATIONS and BENDING VIBRATIONS; where region in IR spectroscopy from 4000 cm^{-1} to 1600 cm^{-1} represents only STRETCHING VIBRATIONS.

Methyl salicylate has two type of functional group that is phenol and ester; in this IR spectrum of Methyl salicylate we locate a peak at 1672.66 cm^{-1} which highlight the presence of (C=O) carbonyl functional group. Peak in region 1300 cm^{-1} to 1200 cm^{-1} indicates the presence of phenol functional group. In IR spectrum of methyl salicylate peak for phenol functional group lies between 1300 cm^{-1} to 1200 cm^{-1} that is 1250.36 cm^{-1} .

Above given data in IR spectrum notify that the derivatives we obtained from expired aspirin tablets look quite effective with little fluctuations due to contamination; with the help of IR analysis we confirm the presence of PHENOL and CARBONYL functional groups in METHYL SALICYLATE.

Structure identification in research work especially in pharmaceutical chemistry should be at priority without

structure identification in pharmaceutical chemistry department we cannot predict about the conclusion or result. Therefore, I will proceed for the NMR Spectroscopy of both samples one by one specially the proton NMR.

NMR INTERPRETATION:

NMR spectroscopy is a powerful tool in order to identify about structures of unknown compounds. In my research work I mainly focus on Proton NMR which also gives a clear idea about the structures we are dealing with. In proton NMR we simply try to map the Hydrogen atom presents in the molecules, Hydrogen atom behave like a magnet not only Hydrogen atoms but all atoms of different nature behaves like a magnet due to their spin. When we place a deshielded Hydrogen atom in NMR instrument it undergo orientation along with the applied magnetic field, this shift of deshielded Hydrogen atom from its initial position termed as alpha spin; when external electromagnetic radiation applied on affected Hydrogen atom its undergo shift from alpha spin to beta spin; such behavior of Hydrogen atom recorded by NMR instrument.

But a shielded Hydrogen atom behaves oppositely because it do not undergo alpha shift in the presence of applied magnetic field; it directly undergo beta shift due the influence of applied magnetic radiation. This energy difference between both Hydrogen atoms helps to identify the exact location of protons in a molecule.

During interpretation of NMR spectrum we utilize n+1 rule in order to mark the position of singlet's and triplets for particular molecule. Another rule which utilize in NMR spectrum is Pascal's Rule or Pascal's Triangle which simply help to identify about the intensities of peaks in NMR Spectrum.

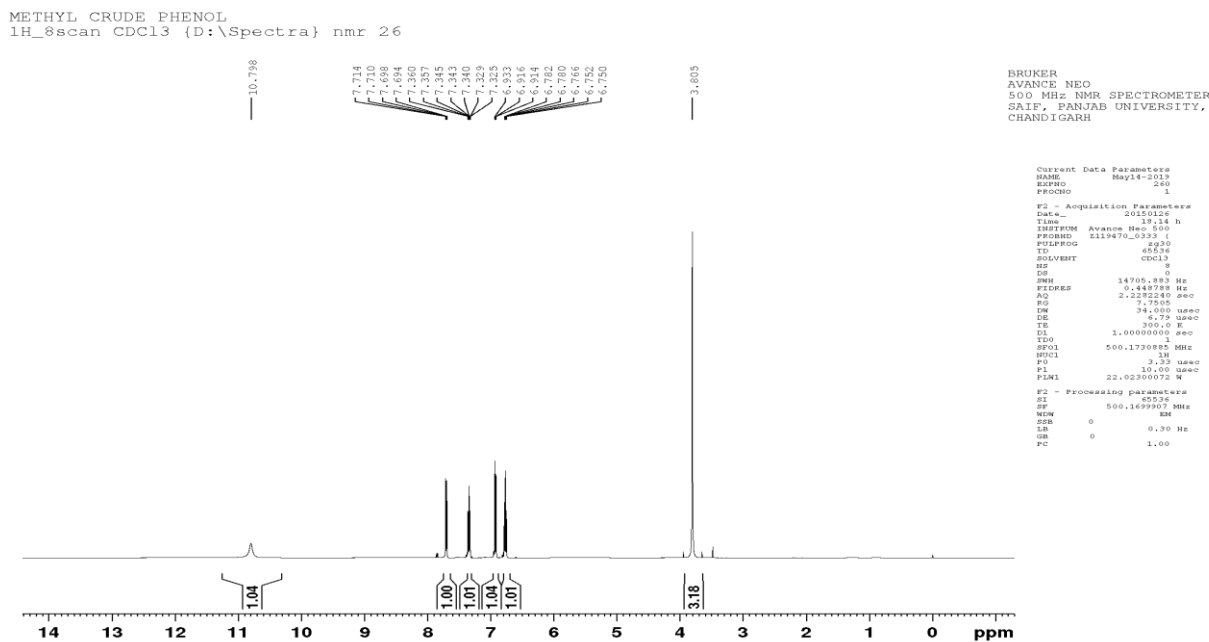


Fig (1) Showing HNMR of METHYL SALICYLATE

PHENOL
1H_8scan CDCl3 {D:\Spectra} nmr 27

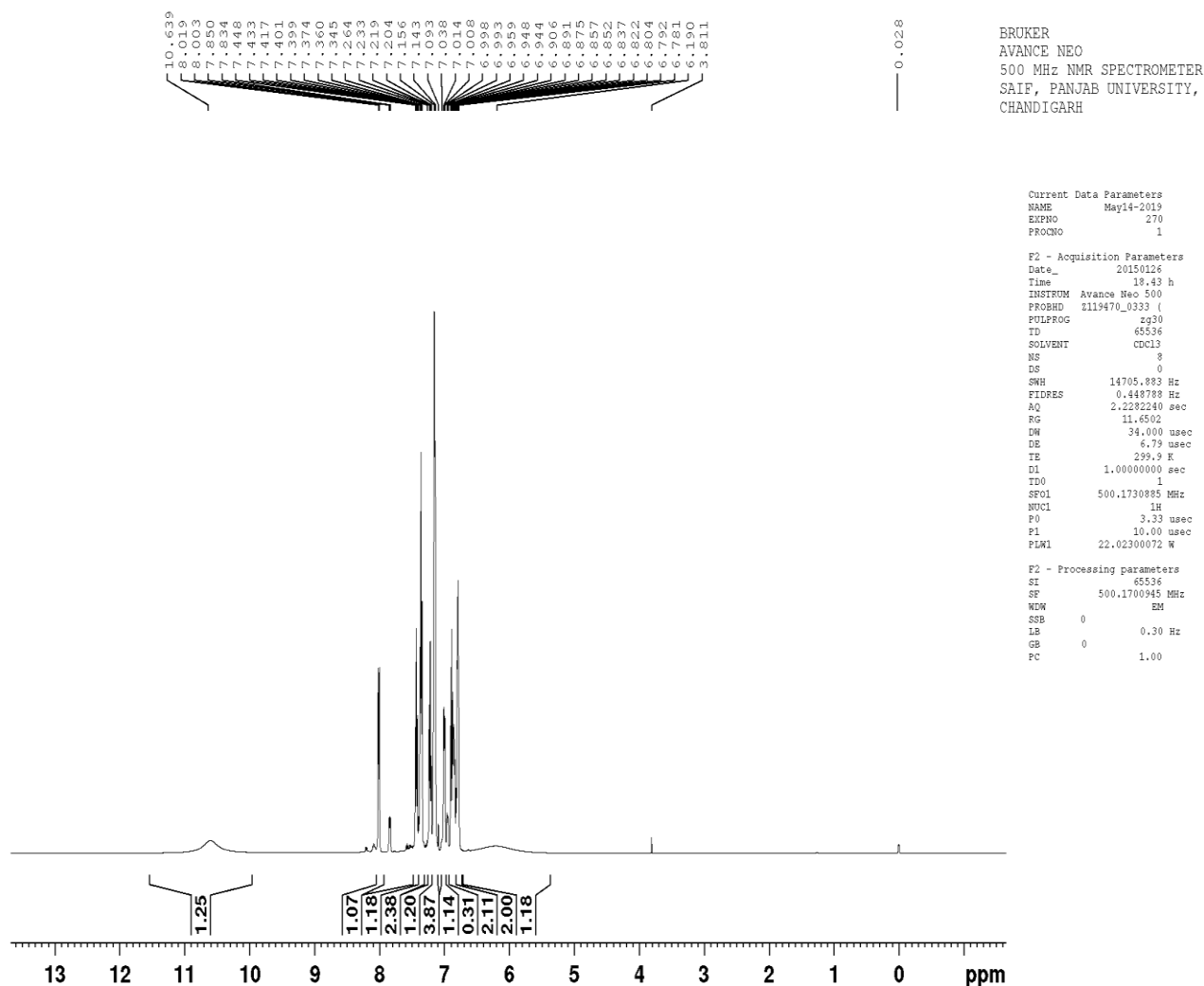
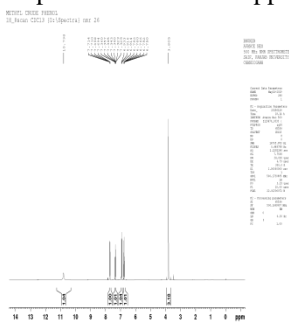


Fig (m) Showing HNMR of PHENOL

In HNMR spectrum of phenol we classified as para, ortho, or meta Hydrogen atoms for which we acquire a peak between 8-7 ppm; we obtained peak at downfield because electro negativity equally distributed in phenol ring due to resonance. We obtained a quartet at 8 ppm which is closer towards the electron rich species that is oxygen atom, which represents the hydrogen atoms closer to oxygen atom; a triplet also obtained for another para position at 6.5 ppm which seems to be far away from oxygen atom. Similarly we attain triplet for ortho and para positions at 7 or 7.5 ppm respectively.



Methyl salicylate also has phenol functional group and one ester group; in HNMR spectra of Methyl Salicylate we attain a peak between 3-4 ppm that is 3.18 ppm which indicates the presence of carbonyl function group that is ester. And quartet triplet is located between 7-8 ppm which confirms the presence of OH-group which confirms the presence of phenol functional group.

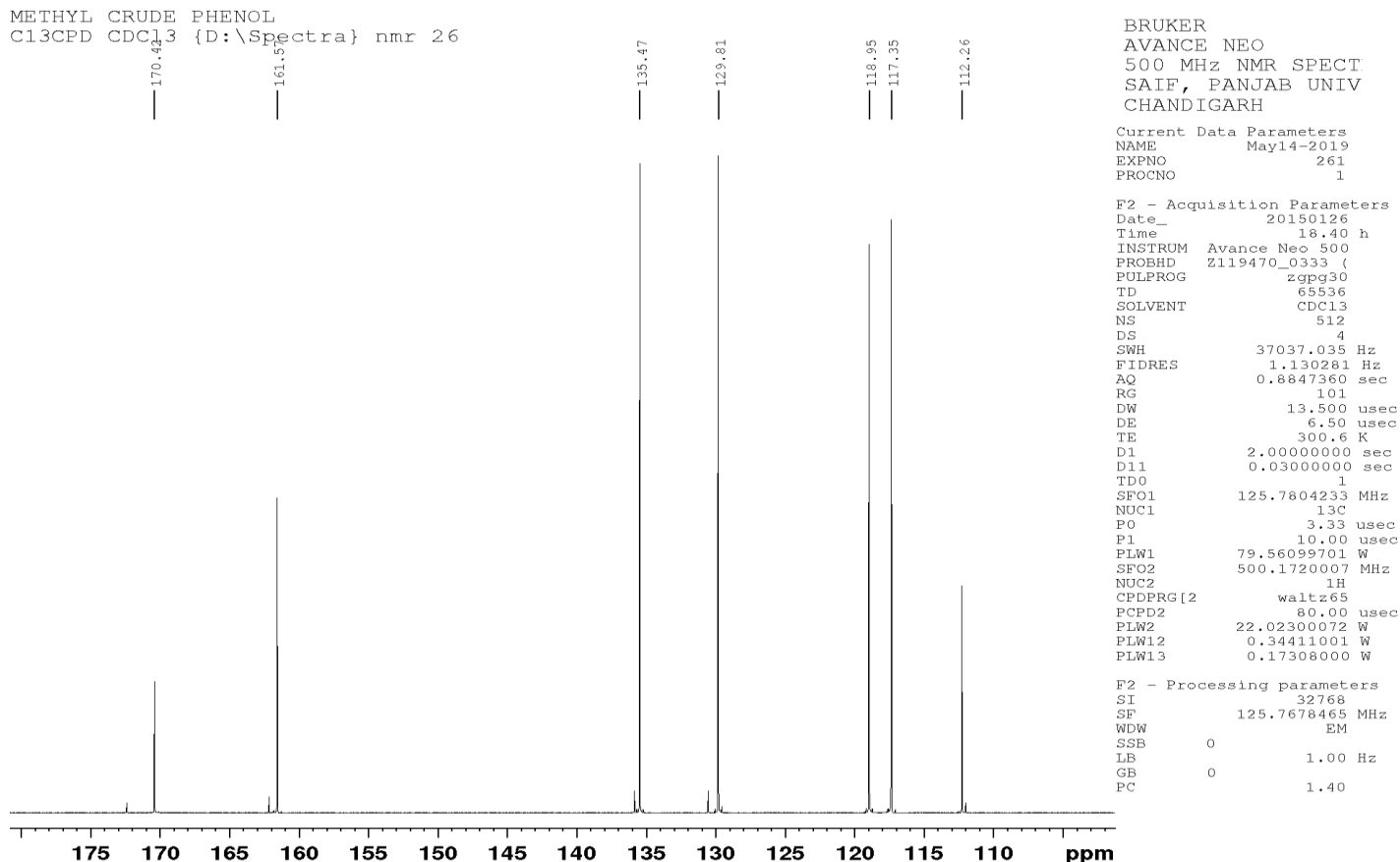


Fig (n) Showing C NMR of Methyl Salicylate

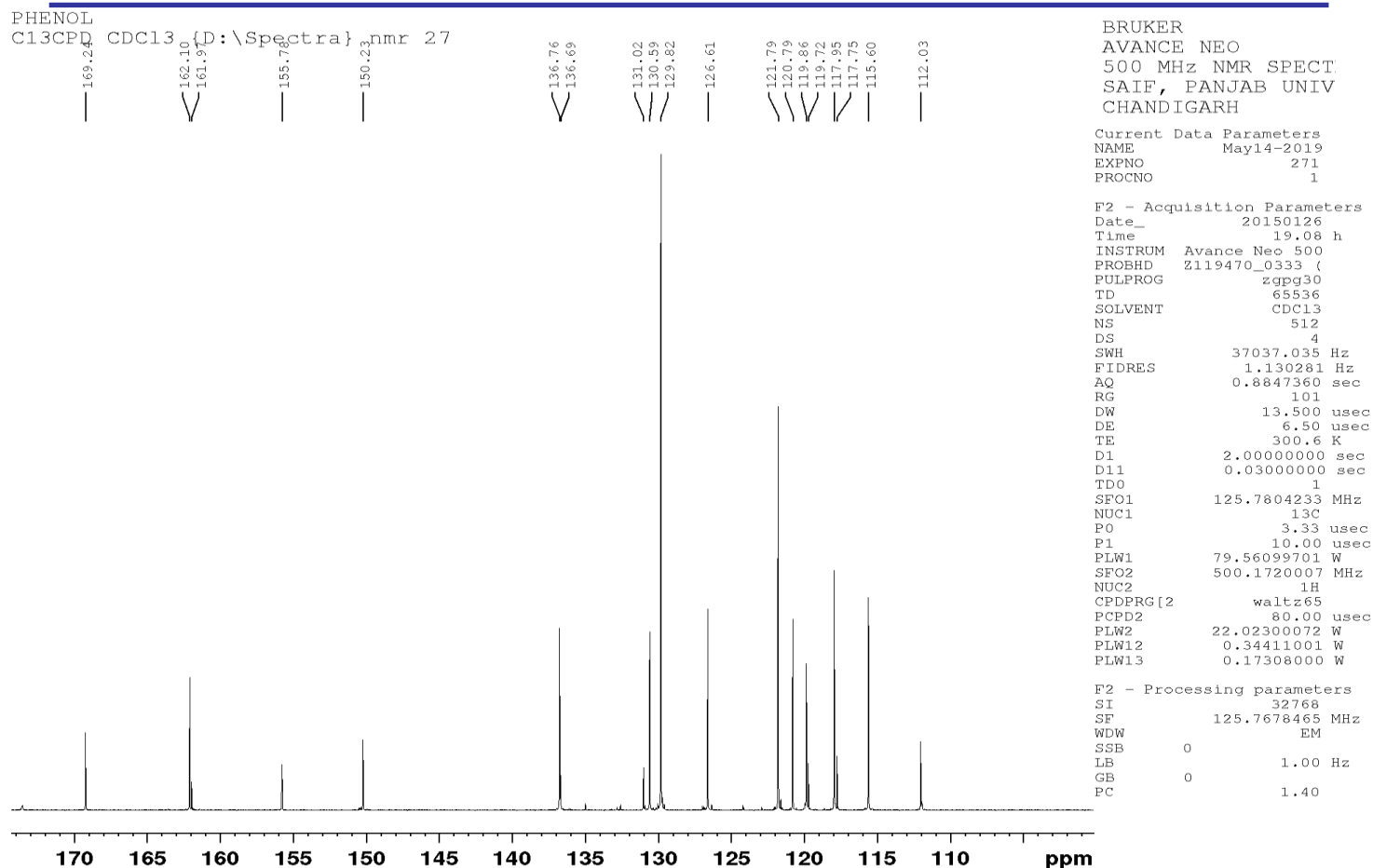


Fig (p) Showing C NMR of Phenol.

(F) CONCLUSION

Awareness among people for proper use of expired or unused drug should be implemented through advertisements and TV lot more; contamination of natural resources due to improper drug disposal practices lethal for both humans and animals. My work is a little spark which may transform into a revolution soon. With the advancement of technology we always bypass the conservation of nature. Development in world is always business oriented; which need to rectify by implementation of nature conservation oriented development.

Waste drugs, from doctor's prescription, self medication and over-the-counter medicines for human and veterinary use, are now widely spread in surface water, groundwater and seawater worldwide. Traces of these drugs in water is major health and environmental concern that is very likely to worsen, expected increase in the use of pharmaceuticals due to higher standards of living worldwide, a growing and aging world population, and the correlated increase in animal farming. So far, more than 150 different pharmaceutical substances and metabolites have been found in various water bodies in Europe, including in drinking water supplies.

Education regarding medicines is essential for that we need to introduce pharmaceutical subjects in school. In survey we found that only graduate persons dispose expired drugs or unused medicines properly. Government have to make strict or strong policies for proper disposal of expired or

unused drugs present in community. Intensity of disposed drugs on living organisms is lethal. Diclofenac disaster is best example in order to understand about the lethal potential of drugs.

Green chemistry opens the doors to design eco friendly reaction procedures and synthesis in which we can reduce the formation of waste materials and increase the yield of reaction procedures. Microwave assisted reaction also helpful in order to decrease reaction time in which reaction completed.

Development of an extraction technique especially for extraction of API (Active Pharmaceutical Ingredients) from expired Pharmaceutical Dosage forms which have negative effect on our surroundings and living organisms. Such extracted active pharmaceutical ingredients utilize in various educational organizations for study purpose only, this also increase the effective and smart utilization of medical waste materials and this way we can also promotes the ecofriendly synthesis and consumption of drugs in our society.

From my above studies I found that reuse or recycling of drug waste looks more effective as compared to deposal of drugs.

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