

# Recycling of Expired Chemical Drugs and Controlling of Organic Chemical Compounds

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## Abstract

*Expired chemicals in chemical medicines represent a big problem in chemical medicines and we must find ways to treat expired medicines. It proposes a new technology for reuse instead of burying it with ordinary waste or instead of burning it in the ovens of the soil company, The side effects of an expired medicine (its chemical substances are out of date and ineffective in healing) are any unwanted effects of the medicine. Although many new drugs target the disease more precisely than their predecessors, none of them have hit the target precisely so far. The use of most drugs causes several effects, but only one effect—a therapeutic—is usually required to treat the disorder. However, when using an over-the-counter drug that contains an antihistamine, drowsiness is considered a therapeutic effect. The goal of drug recycling is to take care of the environment. This is achieved by preventing drug residues from being dumped in public garbage and ending up polluting the soil and water. Another advantage of pharmaceutical recycling is that it helps save energy by recycling packaging and using its waste to produce energy. Now that you know how to dispose of expired medicines, whenever you check your medicine cabinet, go to the pharmacy to deposit it. The fake drug market has recently rebounded, with businesses promoting illegal drug recycling, which poses a threat to the health of millions of Egyptians, with the increasing quantities of expired drugs in pharmacies and the inability of some of them to dispose of them. Although the exact number of side effects of drugs is uncertain, they constitute a major and often preventable public health problem. Many new drugs target the disease more precisely than their predecessors.*

**Keywords:** Expired drugs, chemical drugs, recycling, thermal effect on compounds, organic compounds

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## INTRODUCTION

The disposal of expired medicines is a thorny issue around the world, with industrial societies burning expired chemical medicines while controlling emissions, while less affluent societies landfill these wastes. While some countries and companies dump these medicines illegally, other companies resort to storing them waiting for better solutions than re-exporting them to the country of the manufacturer, as stipulated by current laws. Cedar Environmental aims to fight pollution through the development of research and technology [1]. In 2010, the organization applied for a patent on a technology that allows the recycling of plastic bags and other plastic scraps into thick electrical distribution panels (panel boards) that can be used in many applications instead of wooden panels or those made of steel or steel [2, 3].

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## EXPIRED CHEMICALS IN PHARMACEUTICAL DRUGS

All medications can be recycled; however, they should not be mixed with household rubbish or disposed of down the drain. Remove medicines that have expired or are no longer useful to you from the medicine cabinet according to appropriate recycling standards. Examples include the breakdown of many chemical explosives into less stable compounds, and nitroglycerin is notorious in the field; therefore, older explosives are considered more dangerous (e.g., prone to detonation by very small disturbances and even by slight jiggles) than newly manufactured ones. Rubber products are also degraded because sulfur bonds are formed during the vulcanization process. Therefore, old rubber strips and other rubber products have become stickier and more flexible with age. These changes occur more rapidly at particularly high temperatures. The rule that was reported from an experiment is that chemical reactions double their rate for each rise equal to 10 degrees Celsius (C<sup>0</sup>) in temperature because the barriers of activation energy can be easily overcome at higher temperatures. The rule can be applied to reactions whose activation energy values are close to 50 kJ/mol; many of these reactions are important at the usual temperatures encountered; they are usually applied in estimating the validity period and sometimes incorrectly [4–6]. There is enough diversity on this issue that this practical rule cannot be relied upon routinely. This applies to chemical reactions in life to some extent.

### Development in the Viability of Chemicals in Drugs

The world of medicine is vast and ever-expanding, unbound by space or constrained by time. It is always filled with new discoveries that do not align with advancements in other fields. In most industries, an expiration date is a red line that cannot be crossed when dealing with products. However, in the world of medicine—a realm of wonders and oddities—exceptions are common. It is a field where myths and falsehoods often spread faster than facts and established truths. We have heard, with increasing, transcendent voices, calling from afar, from the countries of science and Western civilization, for the possibility of using medicine after its expiration date. The idea of drugs expiring on specific dates to at least half a century (1979), when the US Food and Drug Administration (FDA) began requiring manufacturers to add this information to the label, to ensure that drugs work safely and effectively for patients, and to determine the shelf life of a new drug, the manufacturer tests it under all conditions and factors, such as heat, humidity, and pressure. The drug company then suggests an expiration date to the FDA where it reviews the data to ensure it supports history and agrees with it, but the strange thing is that despite the great difference in the composition of medicines, most of them “expire” after only two or three years, more than \$1 billion worth of drugs that were close to or past their expiration dates, and no one wanted to get rid of these expensive drugs, which might still be safe and effective; Therefore, the study was carried out, and the drugs were tested extensively with supervision by the FDA, and the results were amazing and shocking. Most of the medicines (about 90 percent) were still good and usable, despite their expiry date, as written on them, but this does not mean that all medicines are valid for use after their expiration date [7, 8].

### *Expired Chemical Drug Treatment*

An estimated \$5 billion in usable medicines are wasted each year in the USA, and 50 million Americans report that they cannot afford to take their medicines as prescribed. An excess of unused medicines is wasted each year in healthcare companies and organizations such as long-term care facilities, drug manufacturers, wholesalers, and pharmacies. Patients who cannot buy the prescriptions they need can benefit greatly from access to these safe, unexpired, unopened medicines that would otherwise go to waste. SIRUM takes advantage of technology to connect unused drug surpluses to safety net clinics where low-income patients cannot afford their medications. The SIRUM system then creates automatic donor-recipient matches and facilitates the fast and direct shipment of drugs from the facility to the clinic. During every step of the process, SIRUM aims to make drug donation an easier and more tempting option than drug destruction [9–11].

### Dealing with Chemical Drugs

We had an environmental strategy, including one for treating all kinds of waste, because we would not have faced these endless problems. The first task of this strategy is to know what kind of waste

this is and then try to answer questions about whether there is a need to treat it in special ways. If this waste is classified as hazardous waste, it is imported and not manufactured in Lebanon; then, it is subject to the Basel Convention to control its cross-border movement. Therefore, we must start thinking about solutions from here on. If the quantity is finite and results from the period of war, it is one thing, and if we expect the production of a permanent quantity, another thing. If the Ministry of Public Health estimates the volume of wartime medicines in its warehouses at approximately 500 tons, and if it has been burned, is the problem with medicines that expire annually, estimated at 150 tons as well? In this case, is it not better, rather than drawing up a protocol with the soil company, to draw up a protocol with pharmaceutical companies or their agents to return it? If expired medicines are classified as hazardous household waste that needs special treatment, why do not develop a special plan with other household waste classified as hazardous, such as batteries and electronic devices, in cooperation with the municipalities and collect them in containers in preparation for re-exporting them to the country of origin, especially since they share all of them in the specifications that they are dangerous and that they are imported. The fake drug market has recently rebounded, with businesses promoting illegal drug recycling, which poses a threat to the health of millions of Egyptians, with the increasing quantities of expired drugs in pharmacies and the inability of some of them to dispose of them. Some pharmacists in Alexandria attributed the recent boom in the pharmaceutical recycling business to the failure of companies to collect expired medicines from the market. They warned against the continuation of this matter in a way that represents a phenomenon that threatens the safety of society as a whole and patients, particularly in light of the recycling of these medicines and their repeated use. Mohamed Hamed, a member of the Board of Directors of the Pharmacy Owners Division at the Alexandria Chamber of Commerce, confirmed that the quantity of expired medicines in pharmacies increased, and their inability to dispose of them led to the spread of new practices and negative phenomena in the drug market. He added that the most prominent of these phenomena is the emergence of a drug trade and recycling mafia, and some non-pharmacists, affiliates, and workers in this field are trying to collect expired drugs and buy them from pharmacies [12–15].

*The researcher Muhammad Hamed:* The pharmacist is obliged to deal with the entities that violate the agreement to “clean the market” Hamed pointed out that a year and a half ago, with the signing of an agreement to clean the market of expired medicines, the expiry date of which has passed more than 6 months, many pharmaceutical distribution companies did not commit to withdrawing these medicines from the market as stipulated by the ministerial decision issued in March 2017. He stressed that there were some individual exceptions from some distribution companies to withdraw expired medicines, but it lasted only six months after the date of the ministerial decision, and they did not respond until now and refused to receive and retrieve the rest of the expired medicines. He pointed out that despite the intransigence of these companies in withdrawing expired medicines from pharmacies, the pharmacist is eventually forced to deal with them and buy from them because he does not have another alternative or a source to provide his supplies and needs of medicine. Hamed pointed out that the intransigence of distribution companies led to the emergence of expired medicines in abundance in pharmacies, in light of the pharmacist's inability to return these medicines to companies, which led to the creation of a new trade mafia based on withdrawing expired medicines from pharmacies and recycling them; he revealed that those entities and entities outside the profession purchase expired medicines from the pharmacist only 10% of their value, or replace them with 50% of their value with male stimulant tablets “such as sildenafil derivatives.” He warned that the expired drug trade mafia would sell these drugs to remote villages [16–18].

### ***Details of Perished Substances in the Conformation of Pharmaceutical Drugs***

You should also remove medicines you no longer use or leftovers from previous treatments that you no longer need from your cabinet. It is common for this type of medicine to contain traces of paracetamol or antibiotics. -It is convenient to remove medicines that do not have a leaflet from the medicine cabinet, which helps prevent potential confusion when using them. Similarly, medications that have been exposed to sudden changes in temperature and humidity should be removed. You should know that there are health products that should not be recycled with medicine. Among these

products are thermometers, needles, and gauze. To eliminate this type of material, go to the clean recycling points on which each municipality relies [19–21].

### **RECYCLING OF CHEMICAL COMPOUNDS IN DRUG**

Medicines play an important role in treating several conditions and diseases, and they are found in almost every home, but they are, as it is said, a double-edged sword. Therefore, when they are finished using them, they must be disposed of in a proper way to reduce the risk of harm resulting from unintended exposure to them or as a result of misuse. Here, we will present some methods and instructions regarding the disposal of medicines that we have finished using, unwanted, or unused: transferring unused medicines to specialists to collect them for inclusion in the recycling program, which is the safest and most environmentally friendly way, as it is better to throw medicines in the garbage than to leave them at home, to reduce the risk of family members unintentionally being exposed to it or using it incorrectly. Disposing of medicines in household garbage If there are no specialists in collecting medicines in your area and there are no instructions on how to dispose of them, then you can follow these simple steps to dispose of medicines: mix medicines with soft materials such as dirt, cat litter, or coffee grounds (without crushing medicines in the form of tablets or capsules). The mixture was placed in a container such as an airtight plastic bag. Throw the container in the household waste. Clear all personal instructions prescribed to you from empty medicine containers or bottles so that they are illegible and disposed of. This extra level of protection provides another way to ensure that the medication does not fall into the wrong category. Do not prescribe the medicines prescribed for you to your friends, because when the doctor prescribes a medicine for you, he prescribes it based on your symptoms and personal history, and therefore, the medicine that benefits you may be useless or harmful to others. Several medicines can be harmful and sometimes even fatal if taken by people who are not prescribed them. To prevent these medicines from being inadvertently ingested by children and pets, it is recommended that they be disposed of quickly through a recycling program, such as painkillers, which must be disposed of immediately after use. If there is no other option, you can dispose of the medicine by throwing it in the sink or toilet and following it with a stream of water. However, after reading the instructions for disposing of the medicine that came with it, some medicines may not be thrown into the toilet or sink unless the instructions indicate the possibility of doing so. Although the Food, Drug, and Environmental Protection Agency is interested in the consequences of throwing medicines into the sink or toilet and their impact on the environment, there is no evidence of environmental harm as a result of throwing drugs into the sink. It is important to pay attention to the environmental effects of inhaled products (such as those used in asthma and COPD) because they contain ozone-damaging chlorine and fluorocarbons (CFCs). However, these materials are being replaced by more environmentally friendly alternatives. Read the instructions that come with inhaled products and aerosols because they can be dangerous if punctured or exposed to fire, and to ensure safe disposal, contact those responsible for waste collection and recycling. Unwanted drugs are still chemically active and are collected after being dumped (even if mixed with cat litter or coffee grounds) and sent to wastewater treatment plants. However, these plants are not qualified to remove the drugs, so these drugs reach the rivers and bays. Accordingly, the medicines must be disposed of after the completion of their use in a proper manner, like the rest of the household hazardous waste, and the best way for this is to give them to specialists collecting medicines to be included in the recycling programs [22, 23]. Figure 1 depicts the thermal decomposition of the drugs.

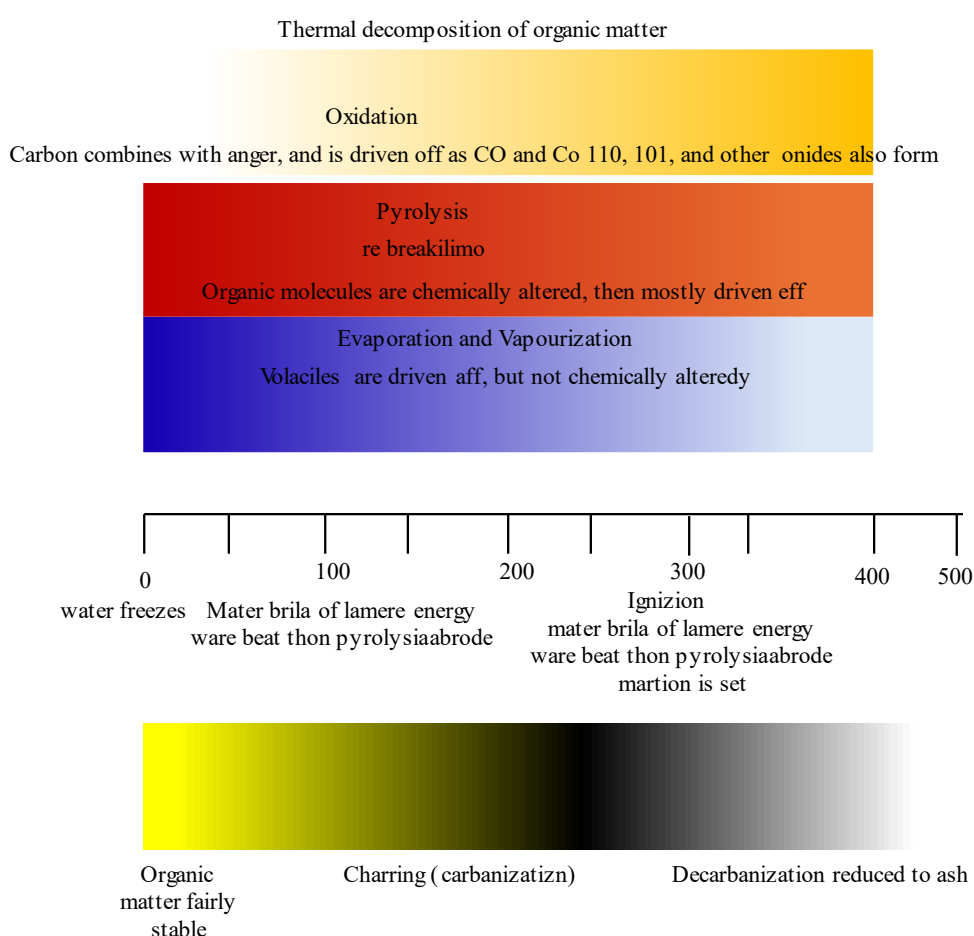
### **Process and Cost of Recycling Chemical Drugs**

He explained that if they are not sold in pharmacies, they are recycled and sold to unscrupulous people and manufactured again, which leads to the presence of fraudulent drugs in the Egyptian market. Then searched for the source of this problem and the source of the presence of these fraudulent drugs because of the reluctance of distribution companies to withdraw all expired drugs.

He stressed that the cost of recycling for pharmaceutical factories is higher than the cost of production for the first time because of the availability of raw materials and the absence of the need to

rerate the material. Therefore, when production companies obtain expired medicines, they destroy them.

Amani Al-Najjar, Vice President of the Pharmacy Owners Division at the Alexandria Chamber of Commerce, confirmed that companies' failure to withdraw expired medicines from pharmacies led to the emergence of other companies working to withdraw these medicines and replace them with other medicines. She added that these companies that appeared recently were withdrawing expired medicines to stock them in pharmacies under the slogan that they were replacing them with the companies producing them, but we were surprised by the appearance of these medicines again being sold on the sidewalks. She warned against the emergence and persistence of these erroneous practices that threaten the health of citizens and their ability to produce, which is reflected in the country's national security [24].



**Figure 1.** Thermal decomposition of chemical compounds in drugs.

In turn, Fathia Mohamed Qassem, Secretary of the Division of Pharmaceutical Dealers and Owners of Pharmacies in the Alexandria Chamber of Commerce, confirmed that the companies' failure to withdraw the percentage stipulated in Ministerial Resolution 499, which is related to expired medicines, led to the emergence of large quantities of stagnant medicines inside each pharmacy. She added that these drugs represent huge losses from the pharmacist's capital, and lead to its consumption at a later stage in light of the high operating costs.

### ***Side Effects of Expired Chemotherapy Drugs***

The use of most drugs causes several adverse effects, but only one therapeutic effect is usually required to treat the disorder. However, when using an over-the-counter drug containing an

antihistamine, drowsiness is considered a therapeutic effect. It is not surprising that side effects of drugs are common; most of these side effects are relatively mild, and many of them go away when the drug is stopped or when the dose is changed, while others decrease in severity gradually as the body adapts to the drug. However, the other side effects of these drugs are more severe. It is dangerous and can last for a long period of time. It is worth noting that approximately 3 to 7% of hospital admissions in the United States are for the treatment of the side effects of drugs. Although the exact number of drug side effects is uncertain, they constitute a major and often preventable public health problem. Many new drugs target the disease more precisely than their predecessors, and none of them have hit the target precisely. Many side effects of drugs are known when they are tested before being approved by the FDA. However, other side effects of drugs, which are usually uncommon, are not discovered until after the drug has been on the market long enough for use in a large number of patients [24, 25].

### Recycling Tests of Chemical Compounds in Drugs

In 2012, the organization asked Dr. Walid Saad, a professor in the Department of Chemical Engineering at the American University of Beirut, to investigate the possibility of including expired pharmaceutical drugs in the process of manufacturing plastic-arrayed eco-boards and to verify that the active substances in the drugs leak out of plastics or keep them for a long time, allowing this mechanism to be an acceptable technique for recycling expired medicines without resorting to burning or backfilling. The initial samples contained the anti-inflammatory drug “diclofenac” and were subjected to leakage tests at room temperature and between fifty and seventy degrees Celsius. The results showed no leakage in the 30 samples containing whole grains, which explains the Abi Shaker.

In another stage, the grains were crushed into a powder, and the tests showed little leakage within ten days. The organization is working on developing a mechanism that includes aluminum in medicines, which limits the leakage process and makes it impossible. The manufacturing process and the results of the leakage tests in the process of including expired drugs in the plastic electrical distribution panels show success, especially in the absence of drug substances from the panels even in the event of an acceleration of the degree Celsius. Figure 2 depicts a chemical factory for recycling of chemical drugs.



**Figure 2.** Chemical factory for the recycling of chemical drugs.

The debate over burning expired medicines reached its peak in 2013 when the process of incinerating several tons of them began at the soil company’s ovens in Siblin. Objections persisted until recently when the town of Kefraya—closely linked to the neighboring towns of Chekka and Heri—voiced its opposition to the practice. This response followed a decision by the Ministry of Environment to incinerate expired medicines at the Holcim company’s ovens, without consulting the relevant municipal councils [25–28], which unanimously rejected the decision and viewed it as an infringement on their authority. Pierre Abi Shaheen, head of Chekka's Environmental Protection Committee, questioned the experience of burning five tons of medicines in 2013, considering that 40 tons of medicines and spoiled materials were burned and that the experiment had failed. According to

the Basel Convention, which specifies how hazardous waste is transported between borders and treated, there is a possibility of deporting this type of waste for treatment outside Lebanon. Some companies appear to have portrayed certain quantities. It was also said that the Syndicate of Medicines Importers has developed a mechanism to dispose of some medicines shortly before their expiry date in cooperation with pharmacies, but this experience has not yet been evaluated.

The Ministry of the Environment signed an agreement with the Holcim company under the supervision of the Technical Audit Office (APAVE). The first experiment took place by burning five tons of these drugs [29–31] in one of the company's furnaces under the supervision of the Audit Office. Whether this agreement is for the disposal of long-range waste or just for getting rid of existing accumulated quantities, and what does it include besides expired medical medicines? Ministry of Environment sources confirm that the memorandum of understanding is about expired medicines from war days only. Further, the future solution will not be to generalize this experience or approve it as an official mechanism, but rather it is better to find a mechanism within the Syndicate of Drug Importers that must return expired medicines to the source, without the Lebanese state or any other party being responsible for the treatment and its cost [32, 33].

## CONCLUSION

The effectiveness of a drug gradually decreases slightly, starting from the moment it is manufactured, but expired drugs do not necessarily lose their effectiveness; the expiration date is only a confirmation that the specified effectiveness will last at least until that date. Check your medications and reuse them at least twice a year. Through this practice, we will all gain safety and well-being and contribute to the care of the environment.

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