University of Basrah

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PURIFICATION OF WATER FROM PHARMACEUTICAL WAST PRODUCTS USING MEDICINAL PLANTS

This project is submitted to the department of pharmacognosy and medicinal plants as a partial fulfilment for graduation in college of pharmacy

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1. Abstract

Water is a major source for survival on this planet. Its conservation is therefore a priority. Pharmaceutical compounds are typically produced in batch processes leading to the presence of a wide variety of products in wastewaters which are generated in different operations, wherein copious quantities of water are used for washing of solid cake, or extraction, or washing of equipment. The wastewaters generated in different processes in the manufacture of pharmaceuticals and drugs contain a wide variety of compounds. Many of these pharmaceuticals were not removed completely during the common water treatment processes, in addition many of these process use chemicals that might have bad outcomes on the general health and surrounding environment, which reflect the need to search for new water purification methods. The use of natural water purification methods such as medicinal herbs and various plants might carry the solution.

2.Introduction

Quran said that every living thing is made of water (verse 30-al'anbia'). In fact, water is truly the driving force of all nature, it is an essential resource for the survival of all living things on Earth. it plays a vital role in human survival, plant growth, ecosystems as well as weather pattern. Therefore, when globe water becomes polluted, the whole nature balance become disturbed. Water pollution might be defined as 'any contamination of water with chemicals or other foreign substances that are detrimental to human, plant, or animal health' (1). water pollution have a various and dangerous outcomes to the human health such as diseases transmitted by contaminated water such as cholera, giardia and typhoid fever as well as respiratory diseases, neurological disorders, cardiovascular diseases and even cancer (2). Globe water pollution might come from various sources such as fertilizers and pesticides; sewage and food processing waste; lead, mercury, and other heavy metals; chemical wastes from industrial discharges; chemical contamination from hazardous waste sites and pharmaceutical waste products(1). Pharmaceutical pollution is considered to be one of the most important causes of water pollution, it can be defined as 'pollution of the environment with pharmaceutical products and their metabolites, which reach the marine environment (groundwater, rivers, lakes, and oceans) through wastewater's (3).

Water purification, on the other hand, refers to the process of removing contaminants and impurities from water, making it safe for human consumption, and have been known since the dawn of history . Early Sanskrit and Ancient Greek writings around 2000 BC are the earliest known recordings of water filtration, while ancient Egyptians were the first to use alum in water purification, and the tomb of Ramses II shows images of water filtration using coagulation (15). However, the light on water purification concept was not strictly headed until the mid1700s, when Joseph Amy obtained the first patent for a water filter, followed by the first home water filters were made available for sale in 1750. It was not until 1854, when a major cholera infection spread through London, Shortly thereafter, chlorine and ozone were used to treat water (4).

Figure 1: Egyptian siphon for beer or to clean water is drawn on one of the tomb walls in Egypt. Painting on wall of tomb of Amenophis II at Thebes, 1450 BC

Now days, water purification by factories involve a series of steps that basically involve : adsorption, boiling, chemical, distillation, electrolysis, microntube separation, reverse osmosis, and ultraviolet (15), and as shown in figure 2. Despite these purification processes, several researches have reported that many pharmaceutical waste products still present in different concentrations within treated waters (17,18) .

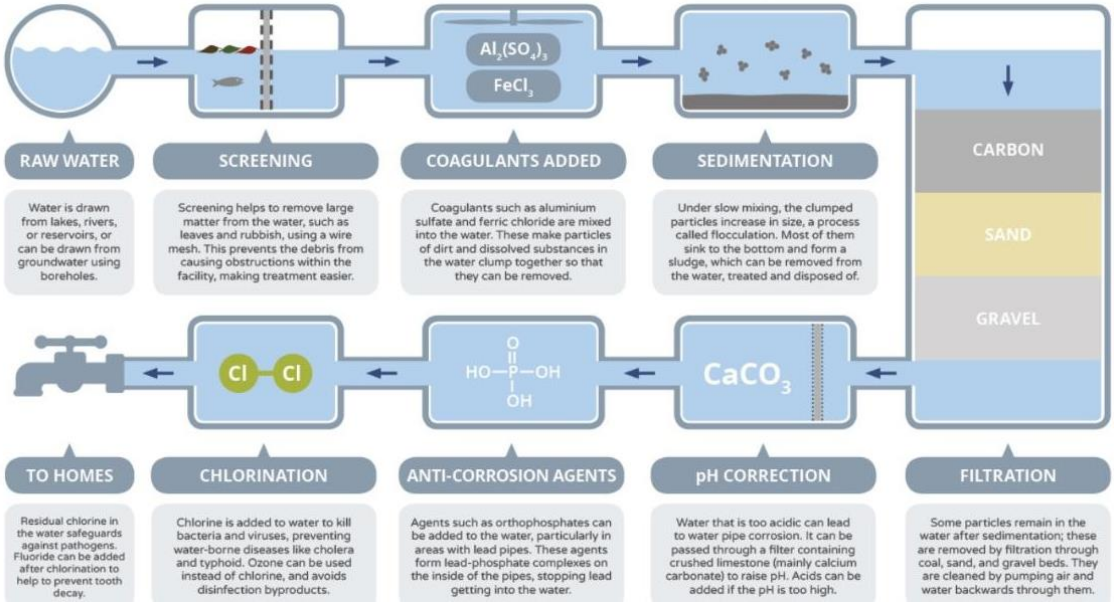

Figure 2: water purification steps

The use of natural materials of plant origin to clarify turbid surface waters is not a new idea, In the West Asia, for example, it is known to use Moringa powdered seeds to flocculate contaminants and purify drinking water (16).In addition, several trails in water purification from pharmaceutical waste products using different herbs and plants have been reported (19,20).

In our study, we tested the ability of two widely known plants; moringa and cilantro; to draw the commonly used non-steriodal antiinflammatory drug Ibuprofen from ibuprofen-containing water.

3. Materials

- Conical flask
- Beaker
- Cylinder
- Stirrer magnetic bar
- Test tubes
- Filter paper
- Dropper
- Mill
- Balance
- Stirrer device
- Centrifuge deInstrument
- Dried Moringa Seeds
- Dried cilantro leaves
- Water
- Ibuprofen

. Shinoda reagent (flavonoid detection test), Mayer's reagent, Dragendorff's reagent, and Wangner's (alkyloids detection tests), 1% and 5%$FeCl_3$ reagent (tannins and polyphenols detection tests respectively).

5. Method:

5.1. Plant collection & drying:

Moringa seeds were bought from local market.
Cilantro leaves and stems were bought from local market, and left to dry under shade at room temperature for 7 days.

5.1.1. Steps of drying process:

• Wash the coriander, after cleaning it from impurities.

• Put it in a strainer, then spread it out on a clean sheet, away from the sun, and let it dry.

• Grind it and store it in sterile containers until use.

5.2. Plant extraction:

Both cilantro leaves and moringa seeds were extracted using the following procedure: In 250 ml conical flask, add 100 ml absolute ethanol to 10 g of plant material, and shake well then store in the refrigrator for 48 hrs. Then filter with filter paper and take the filtrate.

5.3. Phytochemical study:

5.3.1. Flavonoid detection test:

To 1 ml of plant extract filterate add small piece of Mg metal followed by drop wise addition of concentrated HCL.

5.3.2. Polyphenol detection test:

To 1 ml of plant extract filterate add few drops of 5% FeCl3 solution.

5.3.3. Tannins detection test:

To 1ml of plant extract filterate add few drops of 1% FeCl3.

5.3.4. Alkaloids detection test:

3 reagents used for alkaloids detection, drangendroff's reagent, wangner's reagent, and mayer's reagent.

5.4. Water purification test:

5.4.1. Ibuprofen solution preparation:

1 mg of Ibuprofen powder was weighed and dissolved in 1L of water, then (lamda max) of the prepared solution was measured using UV_spectroscopy.

5.4.2. Purification test:

50 ml of Ibuprofen solution (1mg/L) was added to 100 mg of each of (cilantro leaves powder, moringa seeds powder and alum) in conical flasks with stirring at 250 rpm for 30 min. At 25°C and pH= 2. Each mixture was then filtered with filter paper, and centrifuged at 3000 rpm for 10 min. The filterate 5ml of each filterate was then sent for HPLC analysis along with the Ibuprofen solution.

5.4.3. HPLC analysis:

Was done using HPLC chromatography under the following conditions:
- UV absorption = 222 () 234.5 (practical).
- Mobile phase = 220 : 100 v/v (methanol - water).
- pH = 3
- Flow rate = 1.3 ml/min.

6. Results:

6.1. Phytochemical study result

Phytochemical study results are shown in table 1

Table 1: phytochemical analysis of moringa seeds and cilantro leaves

	Detection test		Moringa seeds	Cilantro leaves
1	Flavonoids		++	+
2	Polyphenols		_	_
3	Tannins		+	+
4	Alkaloids	Dragendroff reagent	_	_
		Wanger reagent	_	_
		Mayer's reagent	+	_

(+)for positive result ,(-)for negative result

Figure3: shinoda test of moringa seed extract

Figure 4: Polyphenol test of moringa seed extract

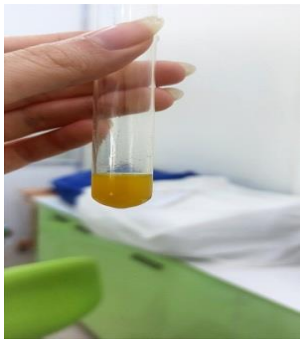

Figure 5: mayer's test of moringa seed extract

Figure 6: shinoda test of cilantro leaves extract

6.2. Water purification test results:

HPLC analysis results are shown in table 2

Table 2: HPLC analysis of ibuprofen moringa ,cilantro and alum

	Material	Concentration remaing	Retention time(minute)
1	Ibuprofen	100%	6.7
2	Moringa seeds	20%	6.8
3	Cilantro leaves	42%	6.7
4	Alum	0.3%	6.7

For sample (1): at Retention time 6.7 minutes, ibuprofen conct was 100 % of standard ibuprofen solution.
For sample (2): only 20% of standard ibuprofen solution remain
For sample(3):42% of standard ibuprofen solution remain
For sample (4):only 0.3% of standard remain

7.Discussion

Moringa seeds are nutrient-dense. They contain potent antioxidants and astringent and anti-inflammatory compounds. The benefits of moringa seeds include protection against cardiovascular disease, lowered cholesterol levels, regulated blood sugar levels, and improved immune system support.As it comes loaded with fiber, it is good for the digestive system. It helps in digestion of food and thus promote healthy living (16). Moringa species contain various phytoconstituents such as alkaloids, saponins, tannins, steroids, phenolic acids, glucosinolates, flavonoids, and terpenes. The diversity of these phytochemical in the genus contributes to its numerous pharmacological uses (17). And the presence of these components was proven by the phytochemical study.The phytochemical study of moringa
Show in table (1).
Shinoda test ,very strong reaction indicate of presence flavonoid in high concentration as in figure (3).

Polyphenol test ,formed yellow to orange colour solution is turbed not dark indicate Poly phenol not presence in moringa because is oldest reagent not fresh as in figure(4).

Tannin test, notice formation of dark blue precipitate indicate presence of tannin.

Alkaloid test:
dragendroff's reagent ,is negative in moringa not form precipitate

wanger reagent, not formation white precipitate indicate test negative

Mayers reagent,white precipitate indicate test positive as in figure e(5).

The health benefits of cilantro may include:lower blood sugar,Rids the Body of Heavy Metals,Protects Against Oxidative Stress,Reduces Anxiety,Supports Heart Health,Settles Digestive Upset,Protects Against Food Poisoning,Supports Healthy Menstrual Function,Prevents Neurological Inflammation,May Help Protect Against Colon Cancer,Soothes Skin Irritation.These benefits due to presence of flavonoids and tannins and the absence alkaloid (18). We infer the presence of these components by conducting a phytochemical stud

The phytochemical study results of cilantro show in table (1).

Shinoda test, reaction indicate presence of flavonoid as in figure (6)

Polyphenol, not formed deep blue or green colour test is negative.

Tannin, formation of precipitate indicate presence of tannin.

Alkaloid/(dragendroff's reagent ,wanger's reagent ,mayers reagent)
.All these test of alkaloid negative not form precipitate .

Water purification test results have shown wthat When the aqueous solution is placed with basic ibuprofen that is not treated with any other substance, the highest concentration will be at the time6.7 minutes(equal to 100% of original concentration which is 1mg/L)and when use moringa the active constituents withdraw part of ibuprofen in aqueous solution of ibuprofen
So that the amount of ibuprofen remaining was 20 of bthe original amount
Effect of cilantro was less because amont of ibuprofen remaining was greater than that which remained in the case of moringa
And of course effect of alum was the greater ,amountof ibuprofen remaining was0.3% of the original amount of ibuprofen.

8. Conclusion :

Our study results came to confirm previous studies results in varying ability of some plants to withdraw some pharmaceutical waste products from water and hence water purifying effect. Despite the fact that alum have shown better HPLC analysis results than both moringa seeds and cilantro leaves under specified forementioned conditions,

but it opens the space for more tests and studies to be withheld under different conditions of pH, temperature, plant concentration …etc.

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