How to remove pollutants of urban water ?

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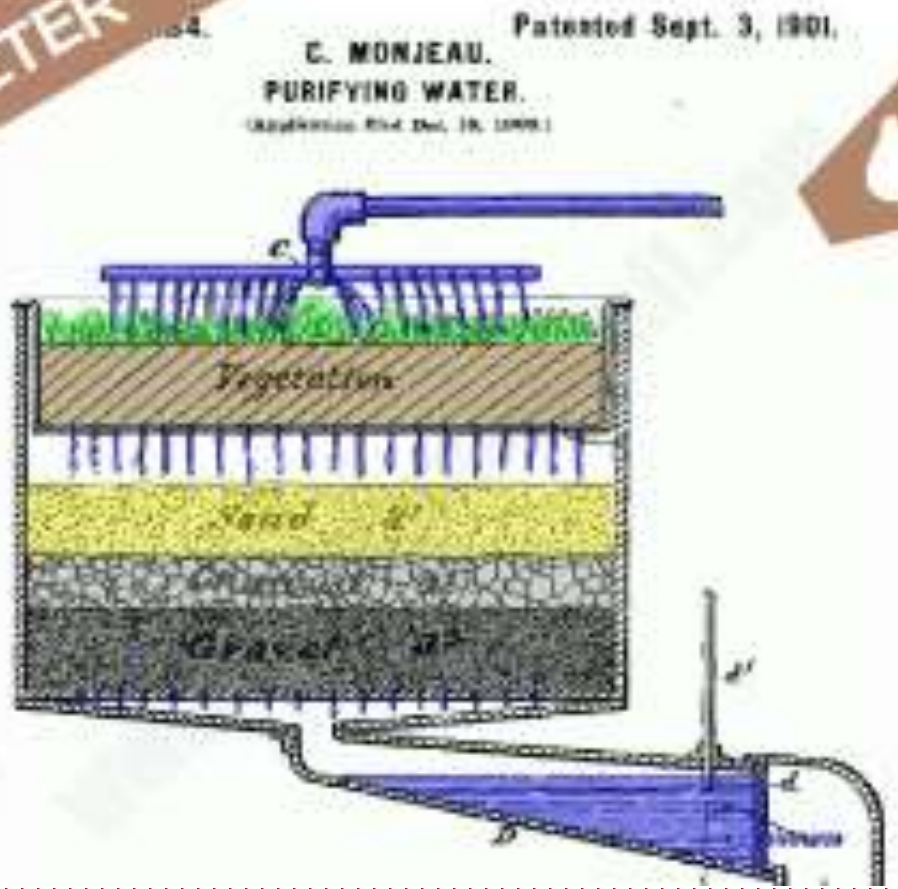
Different Types of Filters

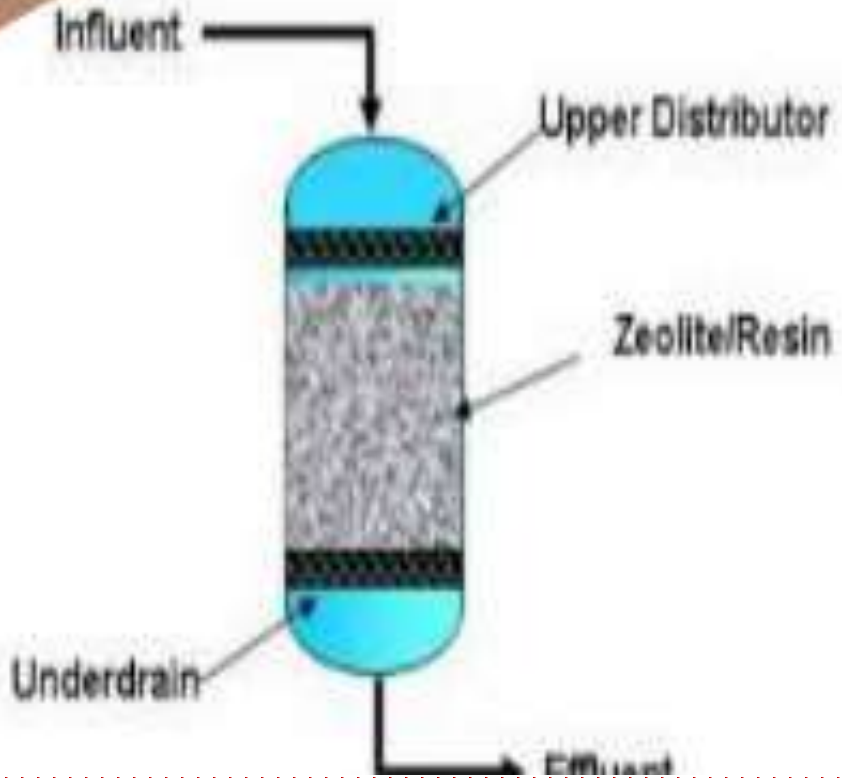
- Broadly filters can be classified into six types :
  - Physical Filters : “filtering by gravity”
  - Ion Exchange : “filtering by exchanging bad ions with good ions”
  - Activated Carbon : “filtering by trapping impurities within pores of carbon material”
  - Reverse Osmosis : “filtering by reversing the process of osmosis thus separating the impurities and water by semipermeable membrane”
  - Distillation : “filtering by boiling”
  - UV Light : “filtering by lights of ultra-violet frequency”

- *A brief description, strength and weakness of the filters are explained in the next slides.*

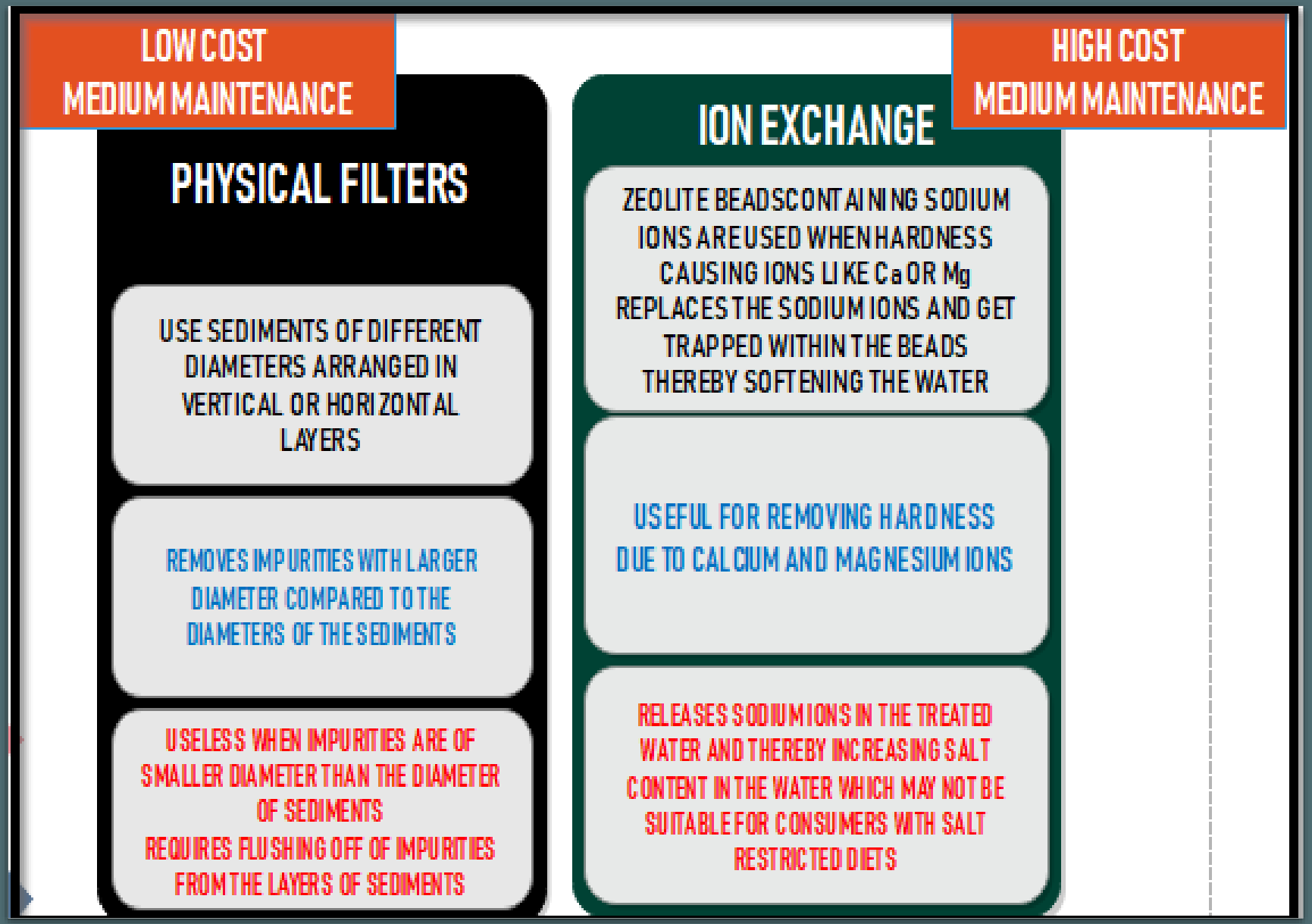
PHYSICAL FILTER



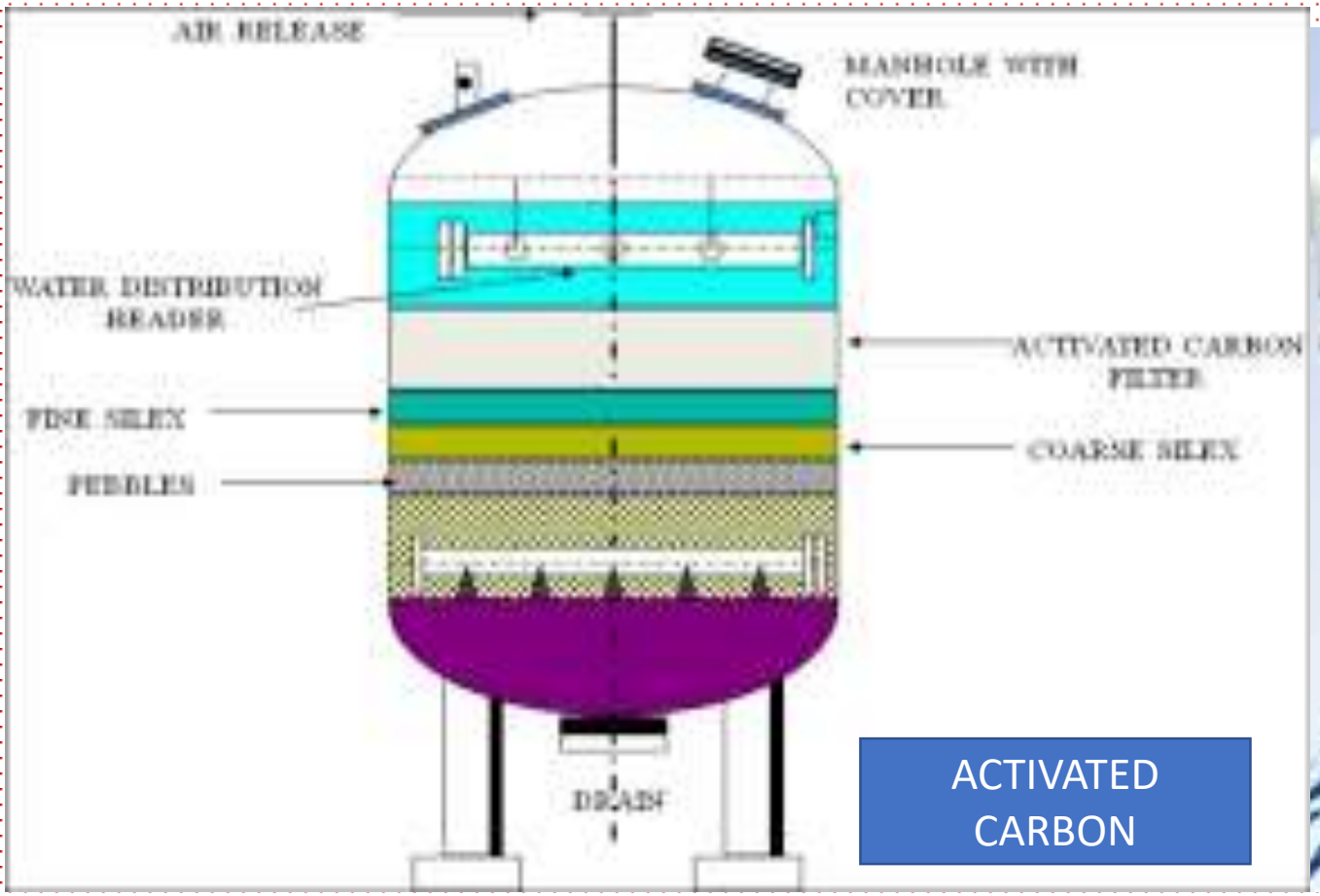
ION EXCHANGER



Different Types of Filters



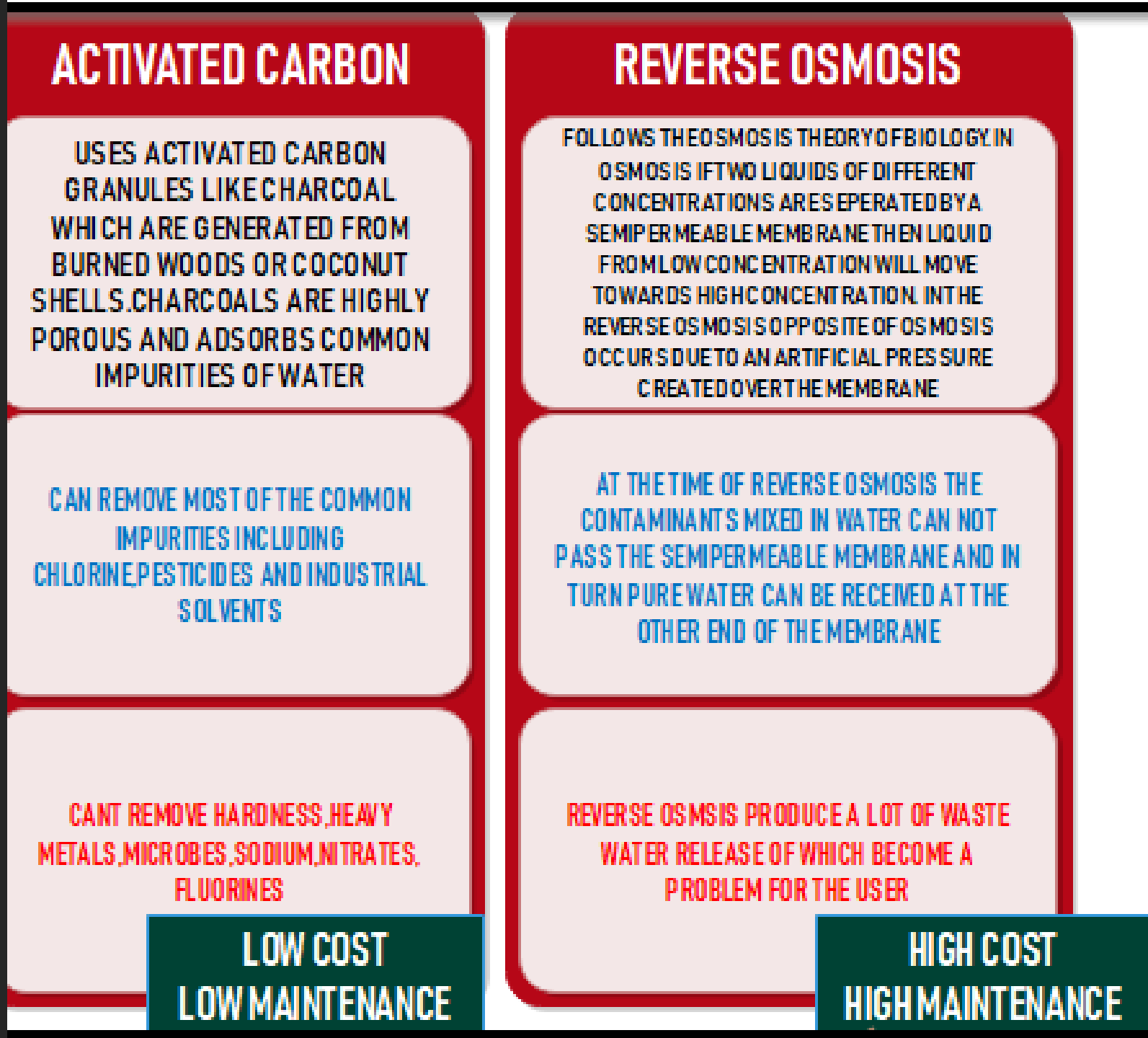
PHYSICAL FILTERS AND ION EXCHANGE FILTERS



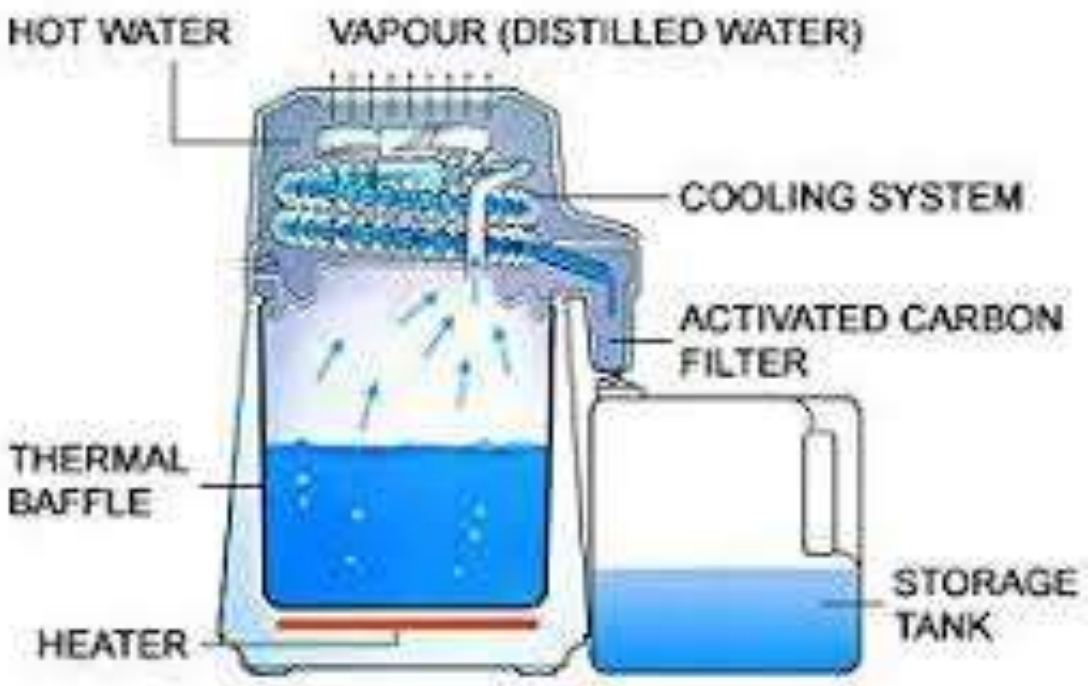
ACTIVATED CARBON

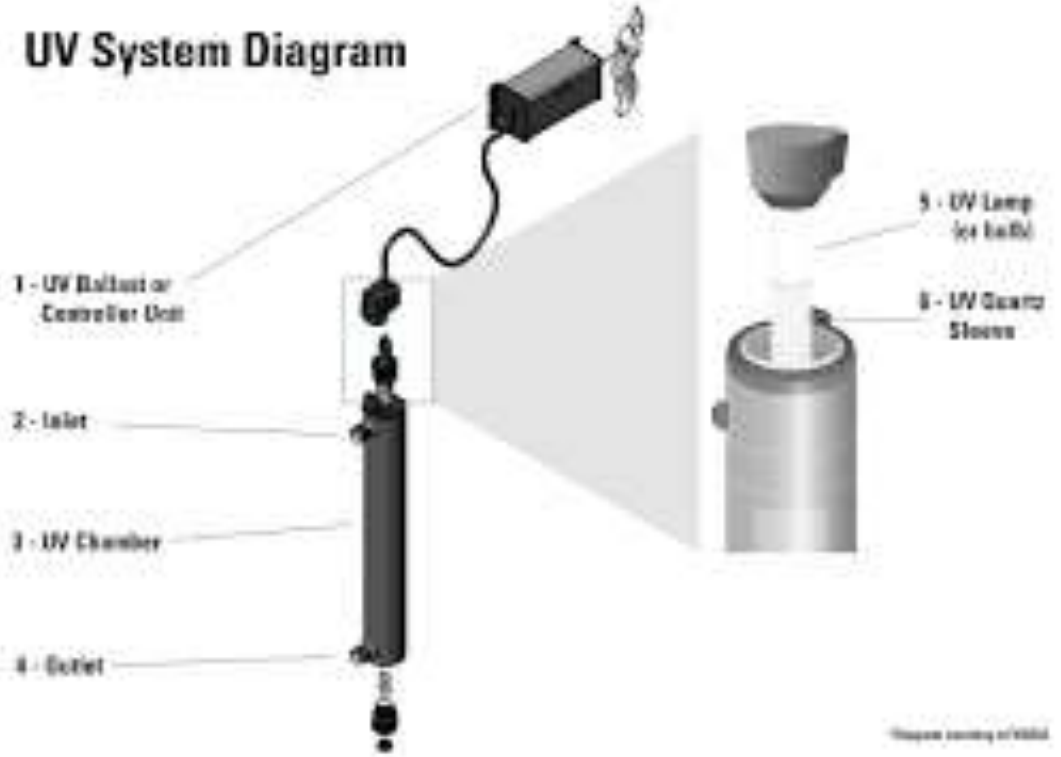
REVERSE OSMOSIS

ACTIVATED CARBON AND REVERSE OSMOSIS FILTERS

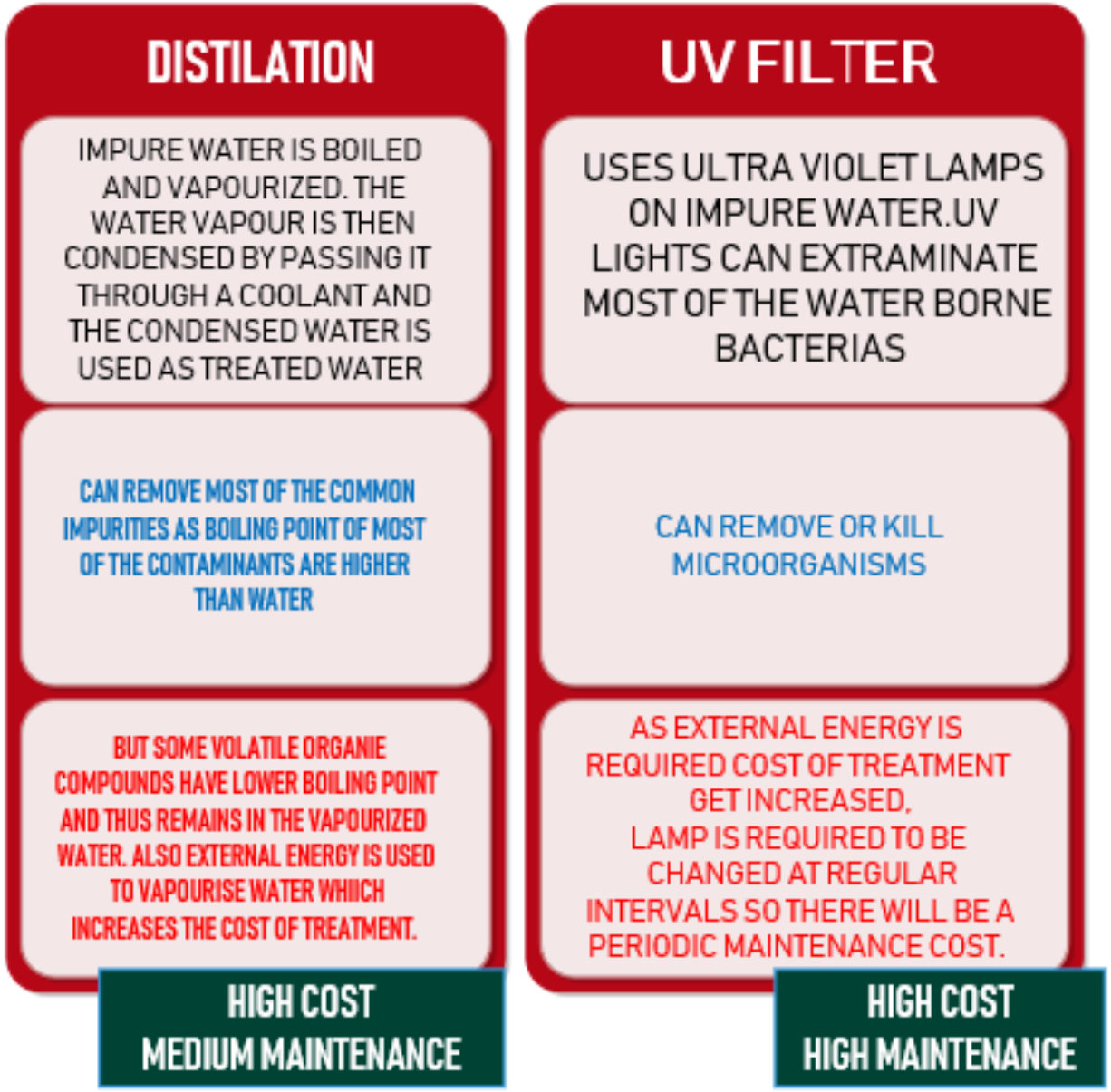


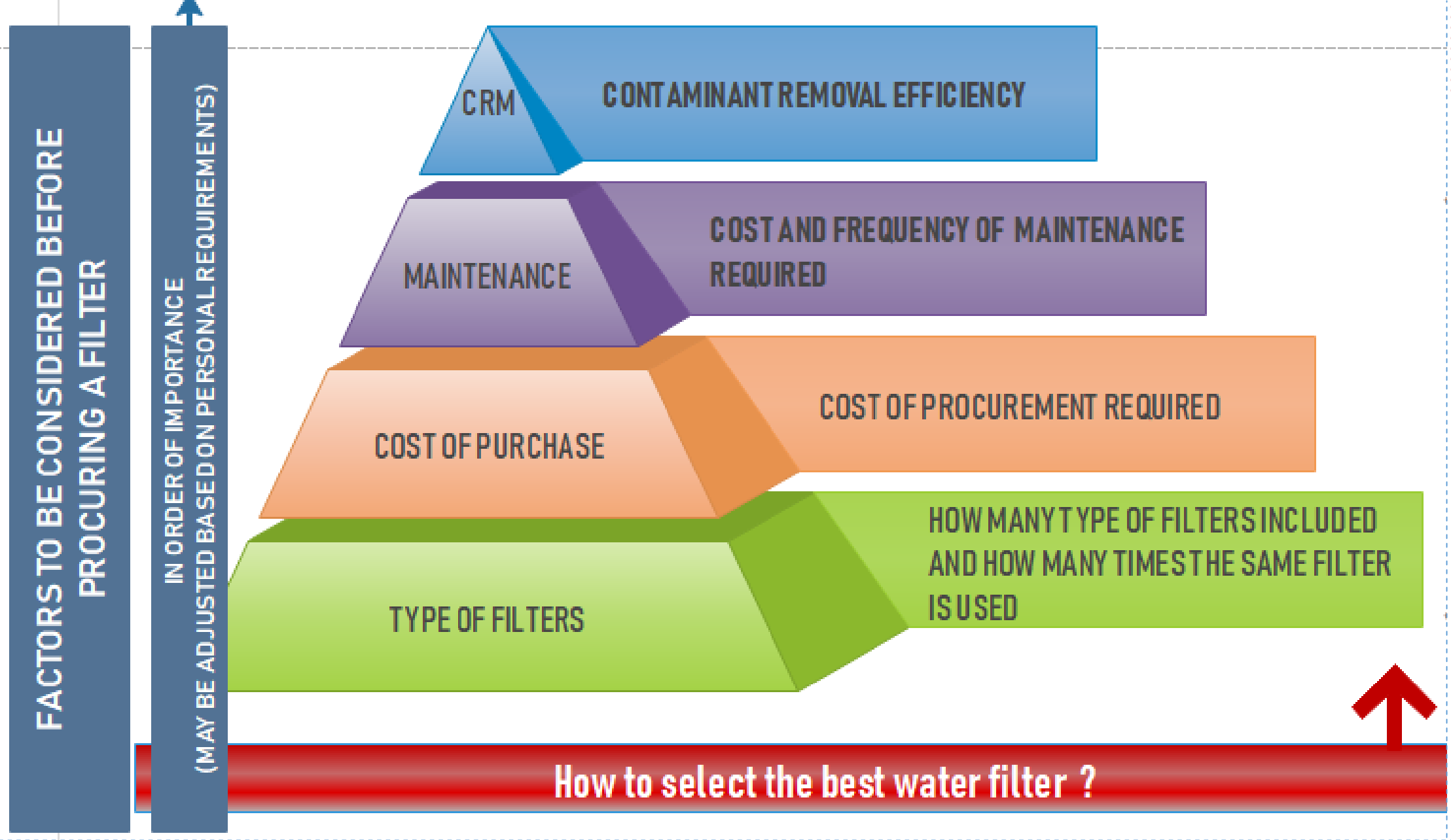
Distillation vs UV Filters





DISTILLATION AND UV FILTERS




FACTORS TO BE CONSIDERED BEFORE PROCURING A FILTER
IN ORDER OF IMPORTANCE
(MAY BE ADJUSTED BASED ON PERSONAL REQUIREMENTS)
CRM
CONTAMINANT REMOVAL EFFICIENCY
MAINTENANCE
COST AND FREQUENCY OF MAINTENANCE REQUIRED
COST OF PURCHASE
COST OF PROCUREMENT REQUIRED
TYPE OF FILTERS
HOW MANY TYPE OF FILTERS INCLUDED AND HOW MANY TIMES THE SAME FILTER IS USED
How to select the best water filter ?

Water Pollutants in Urban Areas

- Sediment, nutrients, oxygen-demanding substances, road salts, heavy metals, petroleum hydrocarbons, pathogenic bacteria, and viruses.
- *Suspended sediments constitute the largest mass of pollutant loadings to receiving waters from urban areas*
- Emerging Organic Compounds : Hormones, antibiotics, surfactants, endocrine disruptors, human and veterinary pharmaceuticals, X-ray contrast media, pesticides and metabolites, disinfection-by-products, algal toxins and taste-and-odour compounds(Pal et.al.,2014)

Some tips and tricks while buying water filters

- **In urban areas** generally water is supplied from surface or waste water treatment plants. At the treatment plant the suspended sediments are already reduced by different high end filtration procedures. The toxic chemicals and other harmful infectious compounds were removed at the treatment plant by chlorination process and then after disinfection the water is supplied to the consumers.
- Thus first of all the supplied water will have high concentration of Chlorine due to the conduction of chlorination at the treatment plant for disinfecting the treated water before supplying.
- Water may also get contaminated with organic compounds like micro-bacterium (thus increasing the Biological Oxygen Demand(BOD)) or by the presence of inorganic pollutants like microplastics (that will aggravate the Chemical Oxygen Demand(COD)) in the pipelines through which water is supplied to your household. There is also a high chance of heavy metal presence.
- There is also a probability of high concentration of Calcium and Magnesium ions (which is responsible for hardness) in the treated water if required treatment for reducing hardness is not available in the treatment plants.

Some tips and tricks while buying water filters

- For such cases a four stage filter will be required having one activated carbon to remove the chlorine and other organic pollutants followed by ion exchange to remove the hardness.
- At the third stage a reverse osmosis filter can be used to reduce the concentration of inorganic pollutants including heavy metals.
- In the last stage a UV light can be utilized to remove the remaining concentration of organic pollutants which will mainly consist of micro-organisms.
- However such configuration will attract high amount of operation as well as maintenance cost. That means such filter configurations will not be economically viable for middle income group of consumers.

Some tips and tricks while buying water filters

- A cheaper alternative can be a three stage filter having a physical filter in the first part to remove the suspended solids which will include most of the inorganic pollutants.
- The second stage can include activated carbon which can adsorb most of the organic pollutants including chlorine and lastly an ion exchange filter which will remove the hardness of water.
- Such arrangement will be cheaper but the quality of the treated water will not be as good as from the earlier configuration of filters.
- But you can avoid the additional requirement of electricity consumption and waste water removal produced at the end of RO process

Some tips and tricks while buying water filters

- If you stay in a location where the **water is heavy** (i.e.presence of Calcium or Magnesium ions) then go for a filter configuration with activated carbon filter in the first stage, ion exchange in the second and physical filter in the last stage.
- This configuration will remove most of the hardness of water during the medium stage and the salt which will be produced by the medium stage as a by-product of ion exchange filter, can be removed by the physical filter at the last stage.
- Off course if you have high budget then you can go for ion exchange at first stage followed by reverse osmosis(RO) filter in the second stage and Ultraviolet(UV) light in the last stage. In this type of configurations, the ion exchange will remove hardness of the water and then the reverse osmosis filter will remove the sodium as well as other inorganic contaminants like sodium, chloride, copper, chromium, and lead; may reduce arsenic, fluoride, radium, sulphate, calcium, magnesium, potassium, nitrate, and phosphorous etc. also (Centers for Disease Control and Prevention,2015).
- Lastly, the UV light will kill the micro-bacteriums which can seep through the semi-permeable membrane of the RO filter.

Thank you

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References

- Abdulrazak, Sani, K. Hussaini, and H. M. Sani. "Evaluation of removal efficiency of heavy metals by low-cost activated carbon prepared from African palm fruit." Applied Water Science 7, no. 6 (2017): 3151-3155.
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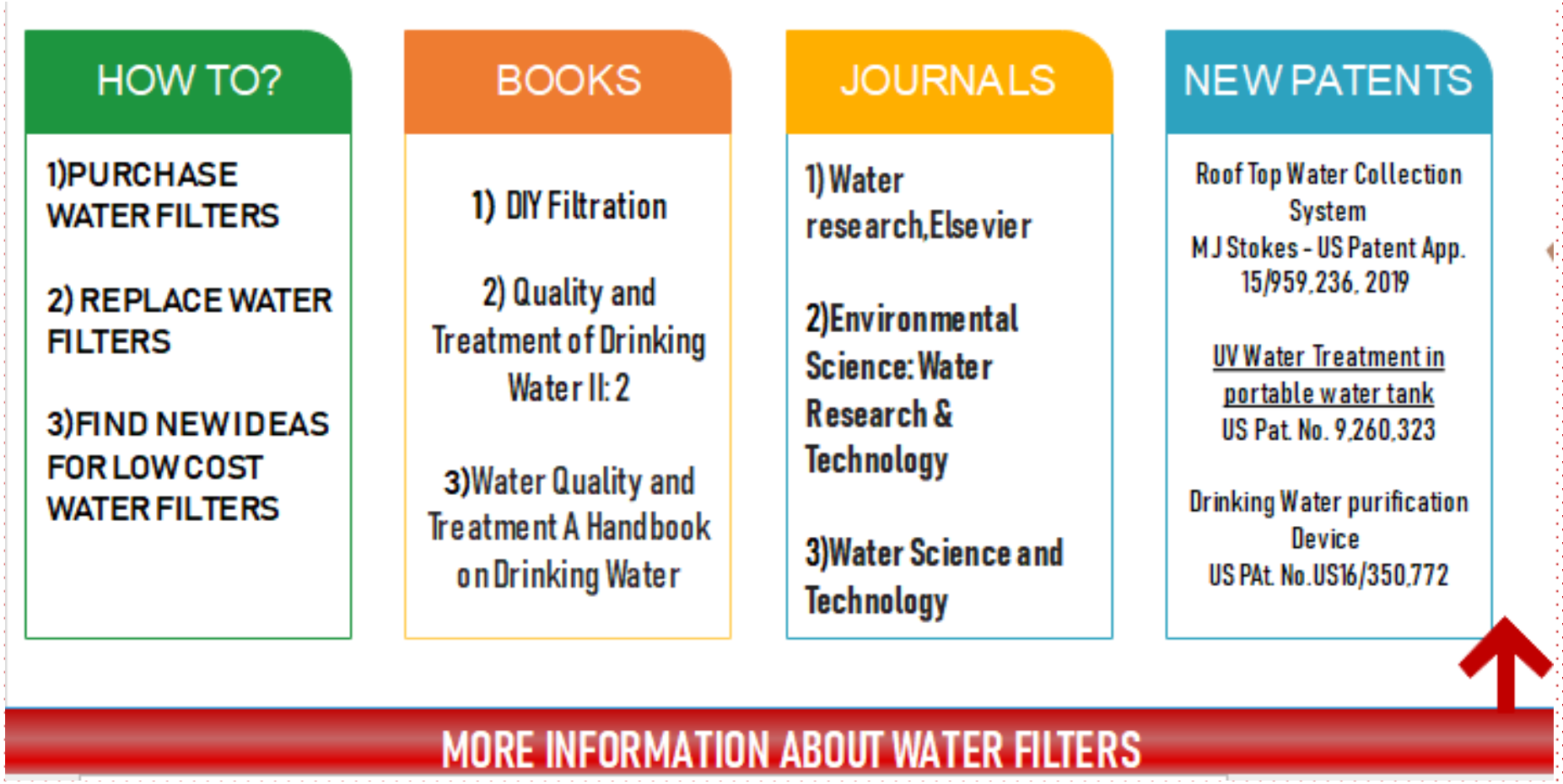
- Pal, Amrita, Yiliang He, Martin Jekel, Martin Reinhard, and Karina Yew-Hoong Gin. "Emerging contaminants of public health significance as water quality indicator compounds in the urban water cycle." Environment international 71 (2014): 46-62.

Bookmarks


HOW TO?
1)PURCHASE WATER FILTERS
2) REPLACE WATER FILTERS
3)FIND NEW IDEAS FOR LOW COST WATER FILTERS
BOOKS
1) DIY Filtration
2) Quality and Treatment of Drinking Water II: 2
3)Water Quality and Treatment A Handbook on Drinking Water
JOURNALS
1) Water research,Elsevier
2)Environmental Science: Water Research & Technology
3)Water Science and Technology
NEW PATENTS
Roof Top Water Collection System
M J Stokes - US Patent App. 15/959,236, 2019
UV Water Treatment in portable water tank
US Pat. No. 9,260,323
Drinking Water purification Device
US PAt. No.US16/350,772
MORE INFORMATION ABOUT WATER FILTERS