

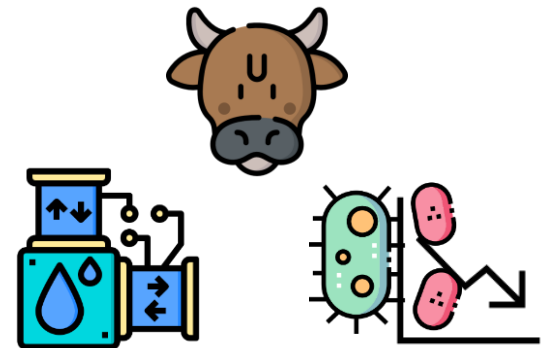
# Implementation of techniques for ensuring microbiological water quality of outdoor watering troughs in cow-calf farms: A literature review

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# Water properties in the source or in troughs

## Organoleptic properties

- ❖ Odor, flavor

## Physical properties

- ❖ T°, pH, total dissolved solids, conductivity

## Chemical properties

- ❖ Nitrites, iron, arsenic, hydrogen sulfide, chloride

## Biological properties

- ❖ Total coliform bacteria, *E. coli* bacteria, cyanobacterial toxins



E. coli  
O157:H7



# Effects of contamination



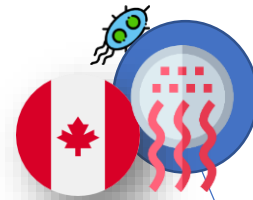
| Parameter                      | Expected values for cattle consumption | Human Drinking Water values (Canada) | Possible Cattle Problem values | Possible cattle problems  |
|--------------------------------|--|--------------------------------------|--------------------------------|---|
| Total coliform bacteria/100 mL | Under 200                              | None                                 | Over 1 million                 | *Fecal contamination  |
| E. Coli bacteria/100 mL        | Less than 1                            | None                                 | Over 1                         | Risk of product (milk, meat), cross contamination in food chain<br>Water contamination, source of human infection |
| Fecal strep/100 ml             | Less than 1                            | None                                 | Over 3                         | Fecal contamination   |
| Cyanobacterial toxins          | None                                   | None                                 | None                           | Poisoning, sudden death, bloody diarrhea, convulsions   |

1. Expected values for cattle water consumption
2. Based on human Drinking water standards from Canada (Guidelines for Canadian Drinking Water Quality)
3. Limit values that may represent cattle health problems. Adapted from: Livestock water quality: A field guide for cattle, horses, poultry and swine (Andrew. O. 2016)

# Global context

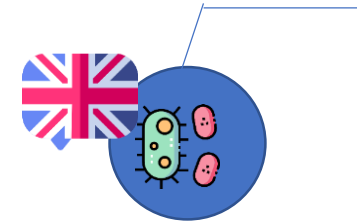
Jokinen et al., (2011)

In the Oldman river watershed (Alberta) was detected the presence of *E. coli* O157:H7 fingerprints from cattle and water isolates.



2012: Canadian XL foods *E. coli* case resulting in the largest beef recall in Canadian history

Water troughs on cow-calf farms, showed on average 20% of samples were contain *E. coli* O157



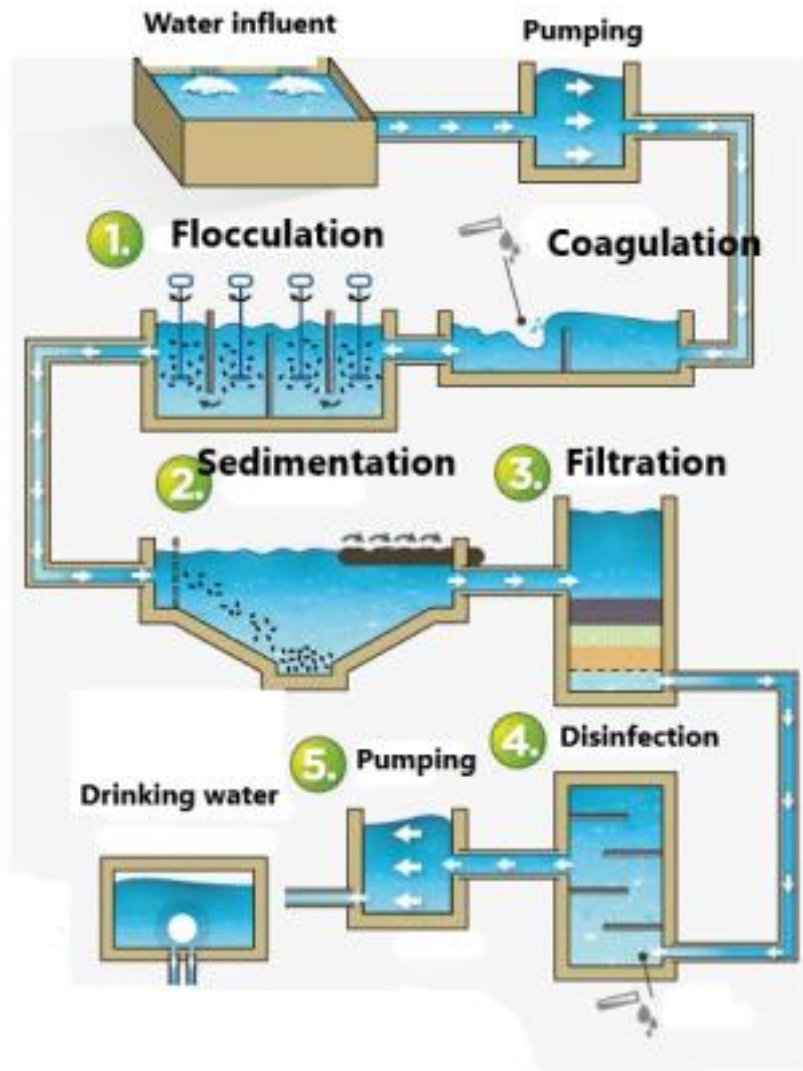
Smith et al. (2008)

Foodborne illness:  
1.6 million of food-born illness  
4000 hospitalizations  
150 deaths

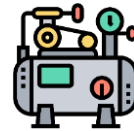


Gouvernement of Canada (2016)

# Drinking water treatment and case



## Aeration



Solar-powered  
compressor and  
farm pond  
diffusion system



Prevention of odors and  
algae growth

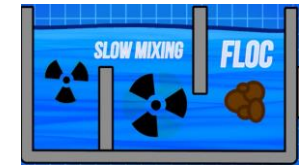


Corkal et al. (2013)

1

2

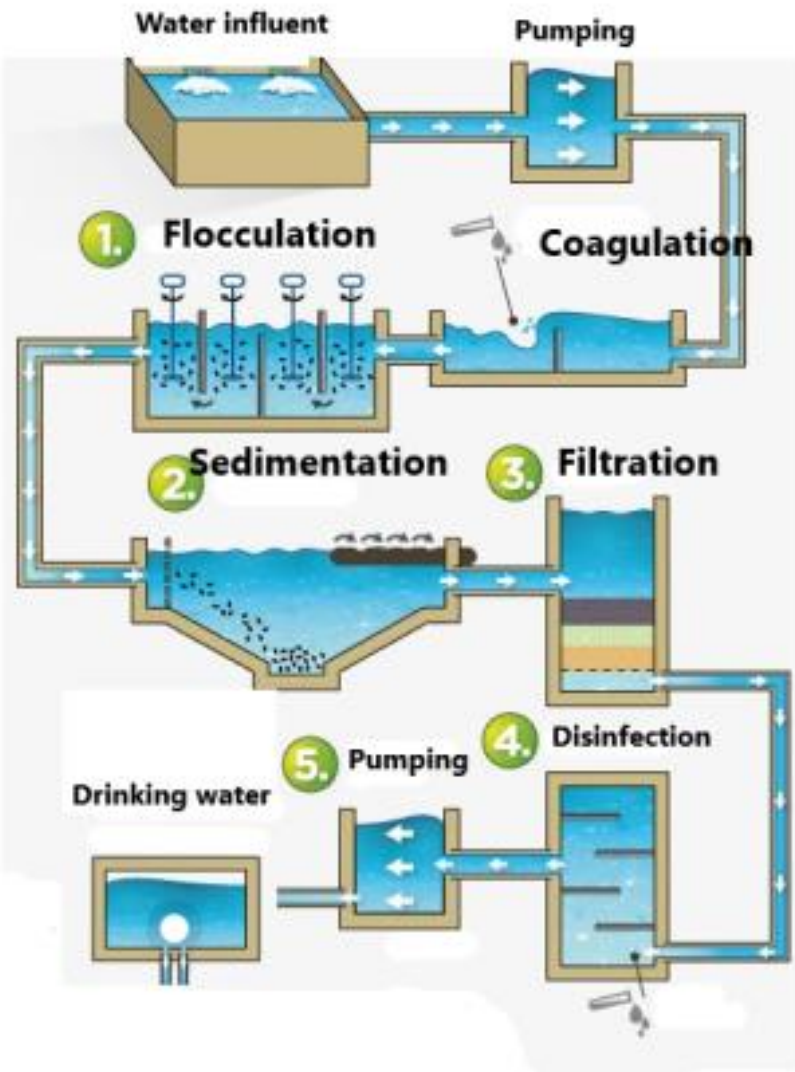
## Coagulation - flocculation - sedimentation



Chemicals were mixed with  
a fixed boat motor



Lardner et al. (2005)



## Filtration



Coagulant dosage



Associated with the  
surface area of the filter  
sand

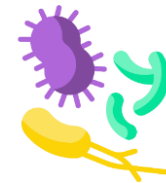
Li et al. (2012)

## Membrane filtration - biofiltration

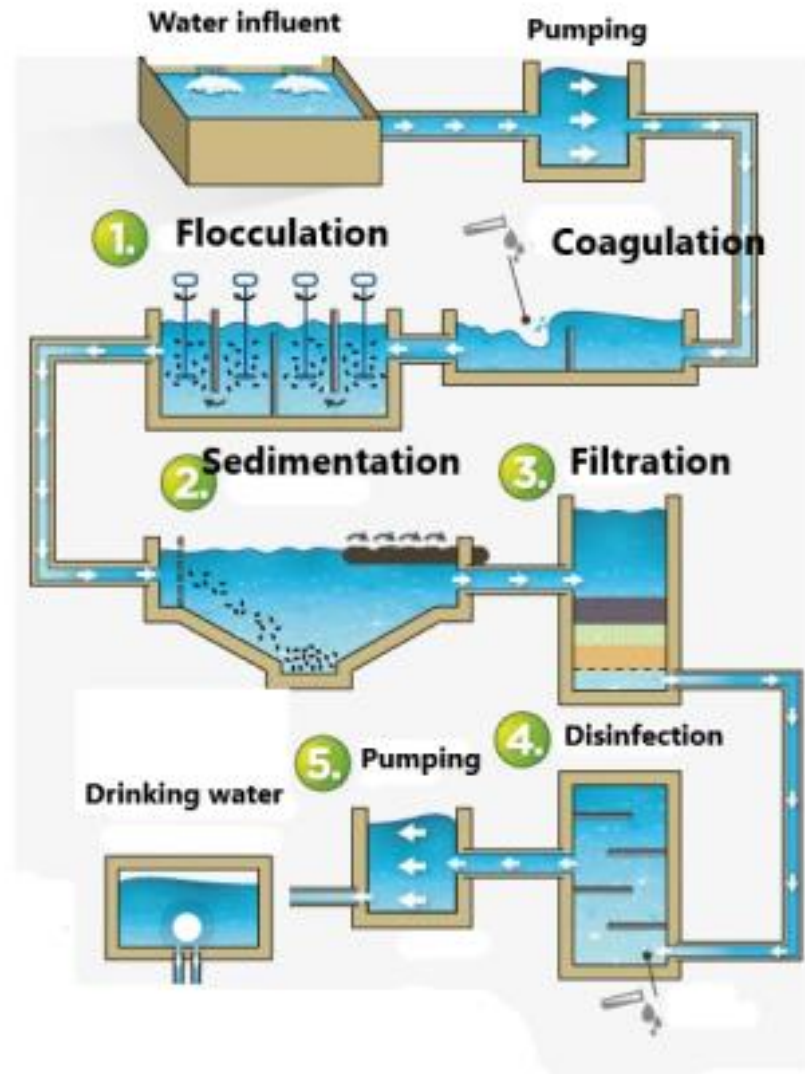
Membrane filtration



Biofiltration



Hooper et al. (2019)



4

## Chlorine disinfection, UV light - Ozone



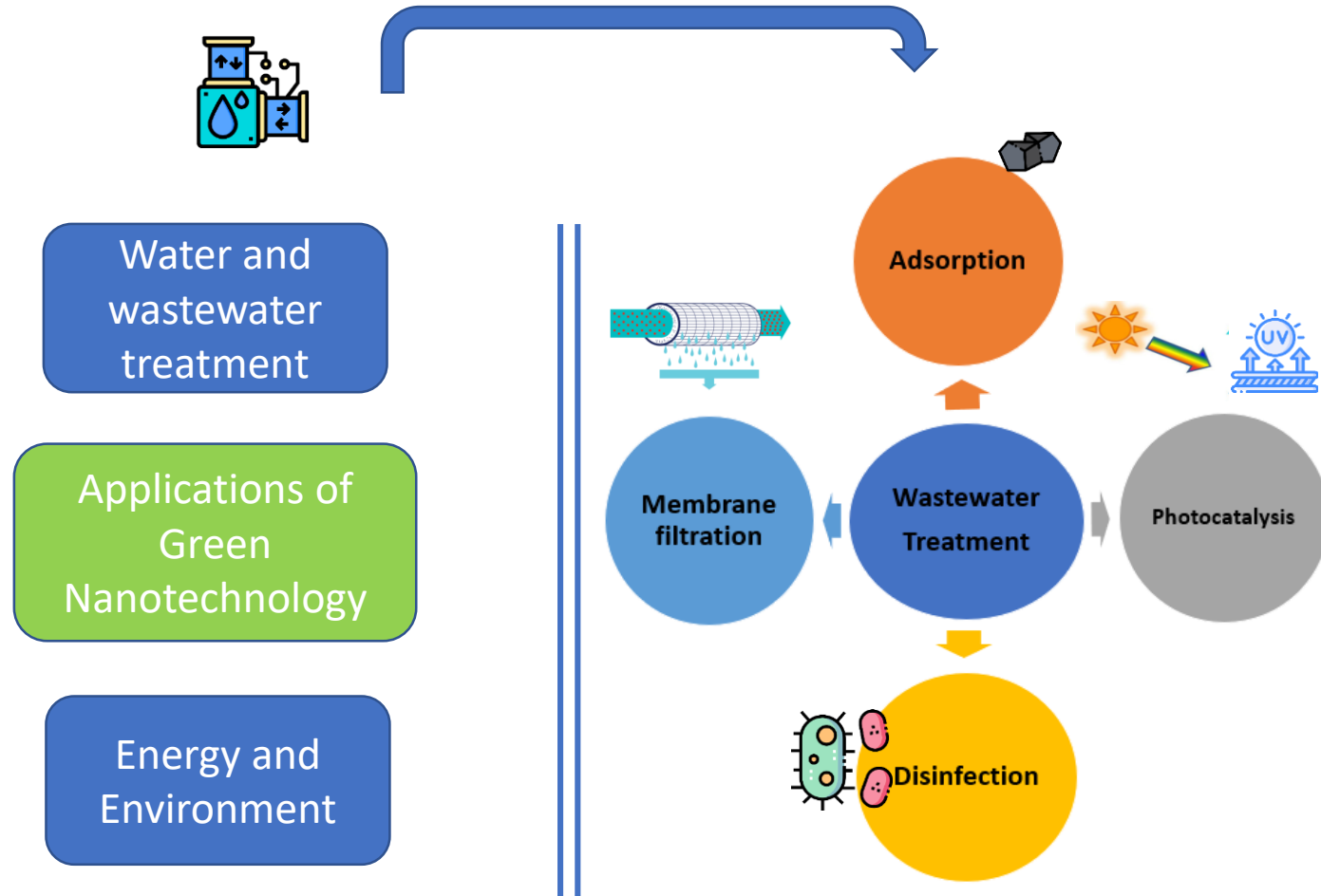
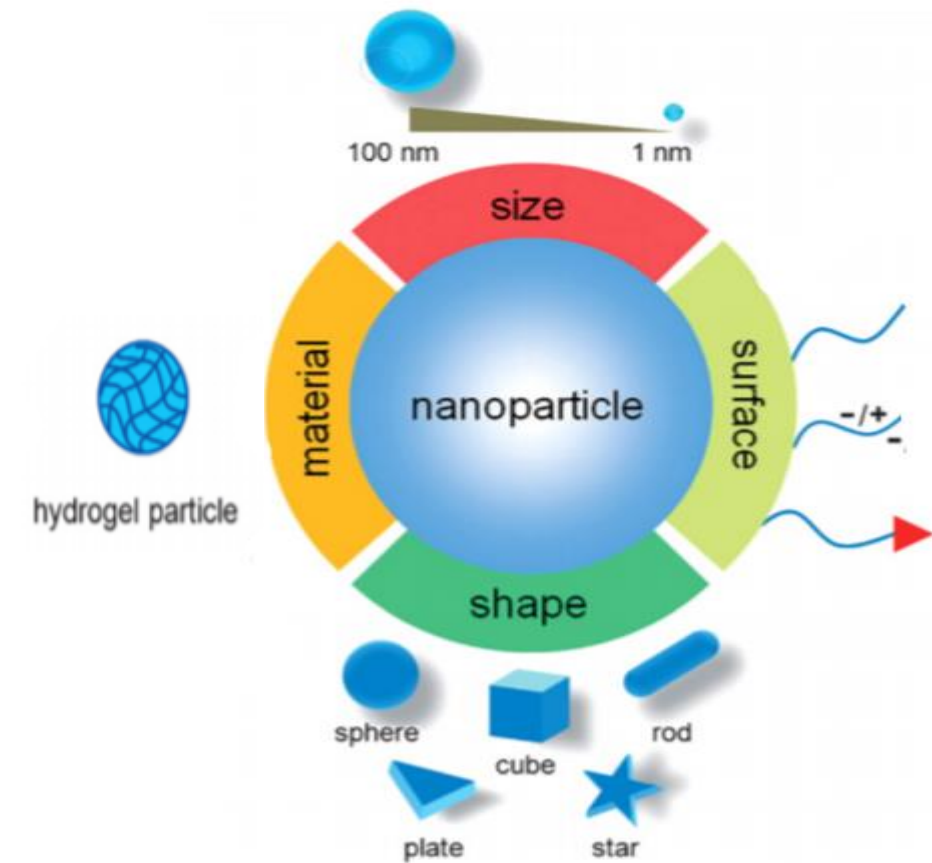
Hruskova et al. (2016)

Abdulrahman et al. (2020)

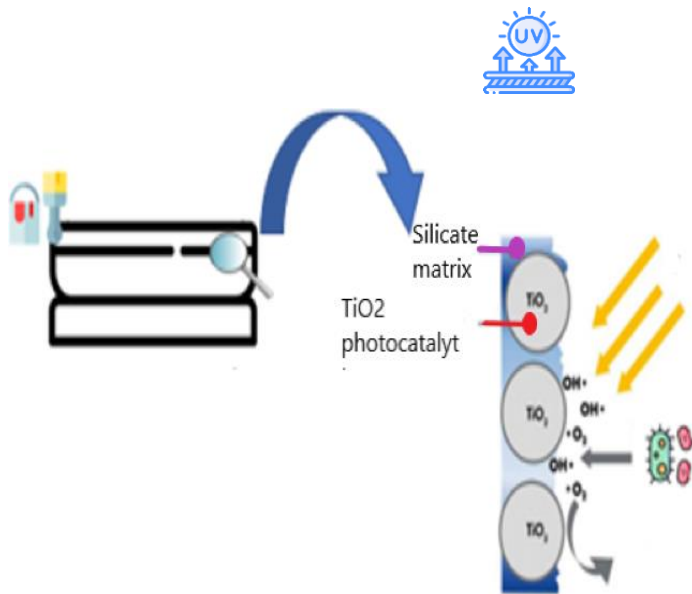
Liu et al. (2019)



# Nanotechnology in water treatment

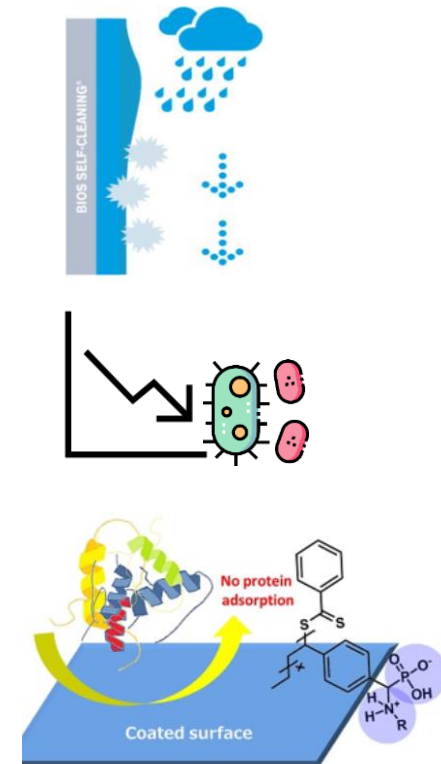


# Nanoparticles



| Application            | Properties   |
|------------------------|--|
| Photo-catalysis        | Particularly in anatase form under ultraviolet light (UV)                      |
| Antifouling properties | Under the influence of both nanoparticles and light                            |
| Biocidal properties    | Growth inhibition, cell inactivation   |
| Hydrolysis catalyst    | Super hydrophilicity, sterilizing, deodorizing, antifouling chemical resistant |

Bet-Moushoul et al. (2015)





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