Water quality aspects

Water quality aspects

CTB3365x Introduction to water treatment

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This lecture

- *Organisms in drinking water*
- *Health-related, chemical parameters*
- *Aesthetics of drinking water*
- *Operational parameters*

Organisms in water

- ***Higher organisms***
- ***Protozoa***
- ***Bacteria***
- ***Viruses***

Higher organisms

Higher organisms in drinking water

Organism	Number (per m^3)	Organism	Number (per m^3)
Ciliata	500	Tardigrada	250
Amoebe	100	Oligochaeta	100
Testacea	5000	Gastropoda	50
Foraminifera	100	Hydrachnellae	50
Turbellaria	100	Hydrach larvae	250
Nematoda	5000	Cladocera	2500
Rotatoria	25000	Ostracoda	100
Gastrotrichia	500	Copepoda	-

Micro-organisms

Pathogenic micro-organisms

Disease-causing

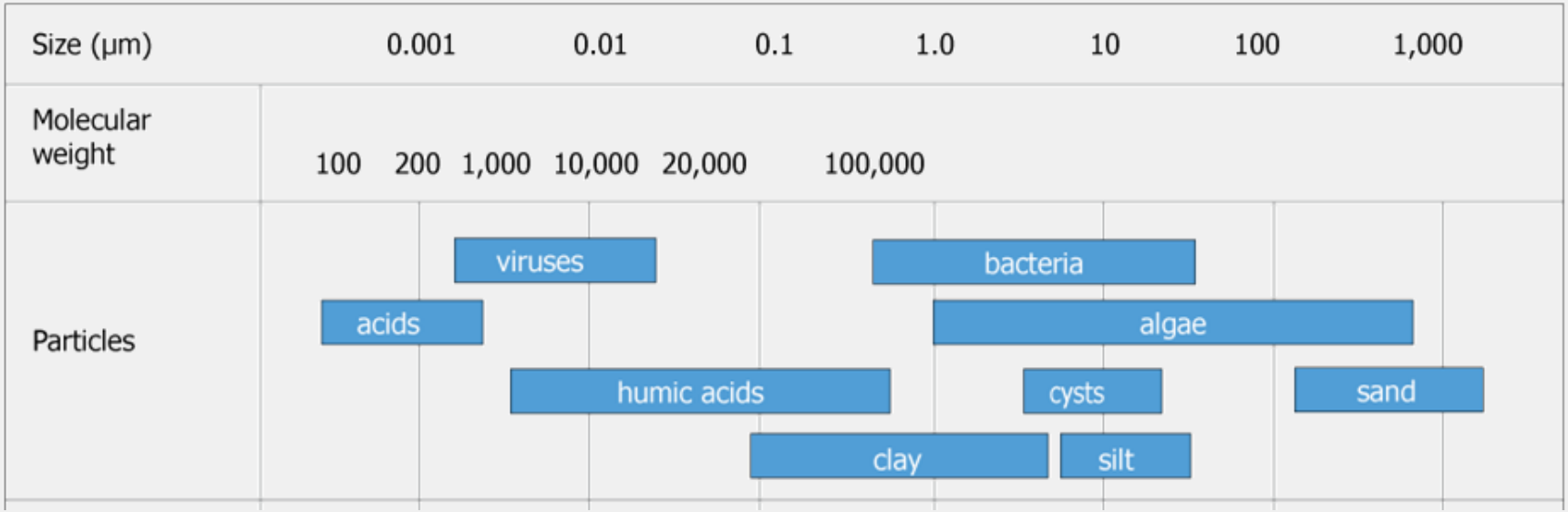
Origin in excreta of humans and animals

- *(un)treated waste water dischrages*

Diseases

Pathogenic micro-organism	Illness
Protozoa (single cell animals)	Diarrhea and stomach complaints
Bacteria	Typhoid fever, Cholera
Viruses	Hepatites, Polio

Size of organisms in water



Indicator organisms

For bacteria

- *E.Coli or total coliforms, expressed as **CFU** per volume*

For viruses

- *Bacteriophages, expressed as **PFU** per volume*

Culturing bacteria

CFU: Colony forming units

Plating and

counting colonies

Health-related, chemical parameters

- ***Metals and related substances***

  Lead, mercury, arsenic, etc.
- ***Organic micro-pollutants***

  Pesticides, hormones, etc.
- ***Desinfection byproducts***

  Bromate, trihalomethanes, etc.
- ***Other compounds***

  Nitrate, Fluoride, etc.

Drinking water guidelines

- ***Health risk***
- ***Detection limit of measurement***
- ***Available water treatment technologies***
- ***National and international (WHO, EU) guidelines***

Metals and related substances

- *Lead, mercury, chromium, arsenic*
- *Natural release into (ground)water*
- *Mining activities*
- *Industrial discharges*

Carcinogenic, kidney, lung and bladder diseases

Organic micropollutants (OMPs)

- ***Pesticides***
- ***Pharmaceuticals***
- ***Human care products***
- ***Drugs***
- ***Gasoline***

Genotoxic, endocrine disruptors

Disinfection by-products (DBPs)

Disinfectants react with natural organic matter and bromide:

- ***Trihalomethanes, haloacetic acids, and chlorite***

  Chlorine by-products

- ***N-nitrosodimethylamine (NDMA)***

  Chloramine by-product

- ***Bromate***

  Ozone by-product

Other compounds

- ***Nitrate***

Agriculture, groundwater

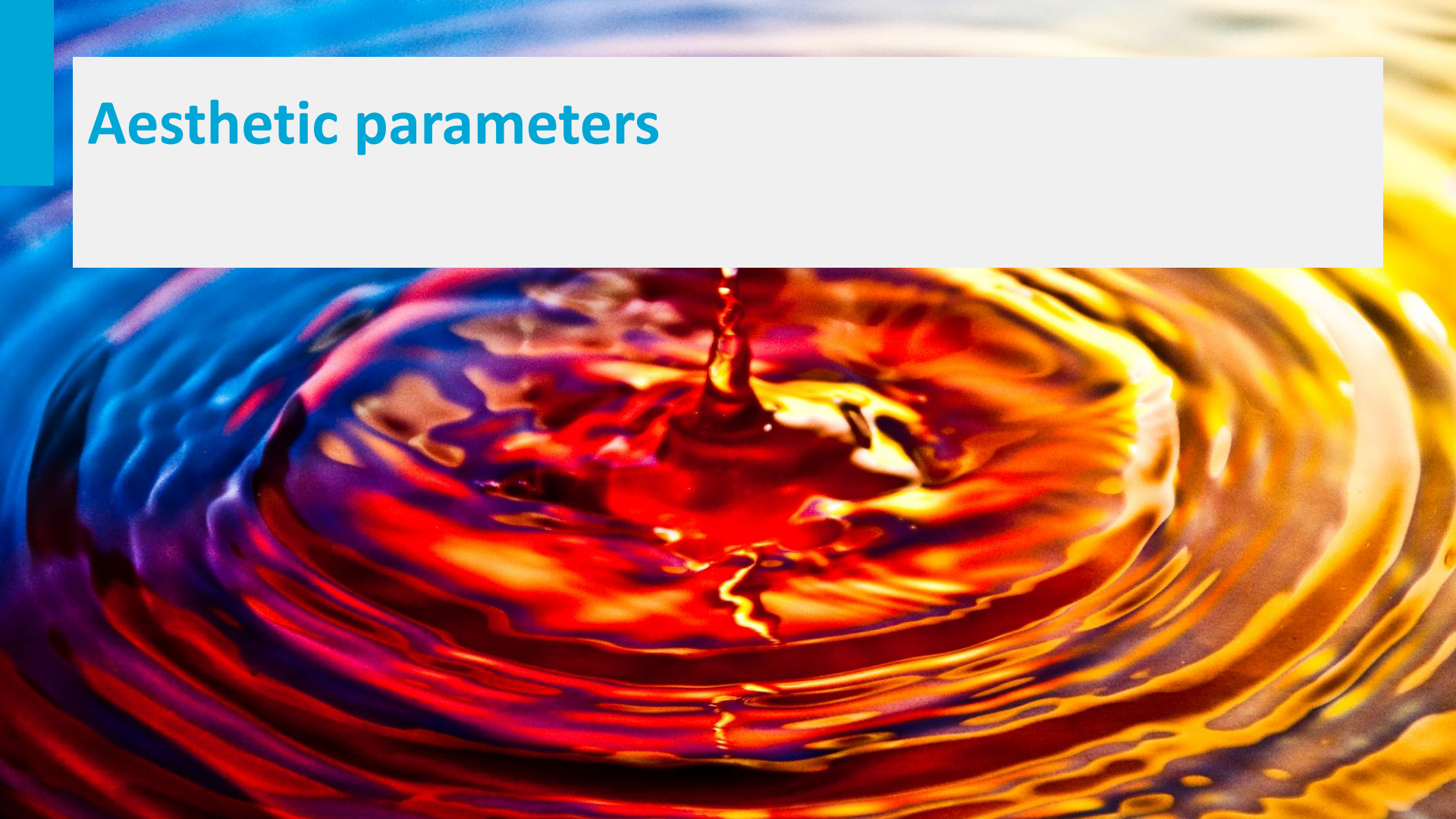
Health hazard as nitrite (blue baby syndrome)

- ***Fluoride***

Natural occurrence in groundwater

Brittle bones and teeth decay

Aesthetic parameters



Appeal of drinking water to the client

- ***Odour***

  By consumer panel

- ***Taste***

  By consumer panel

- ***Colour***

  mg/L Pt/Co

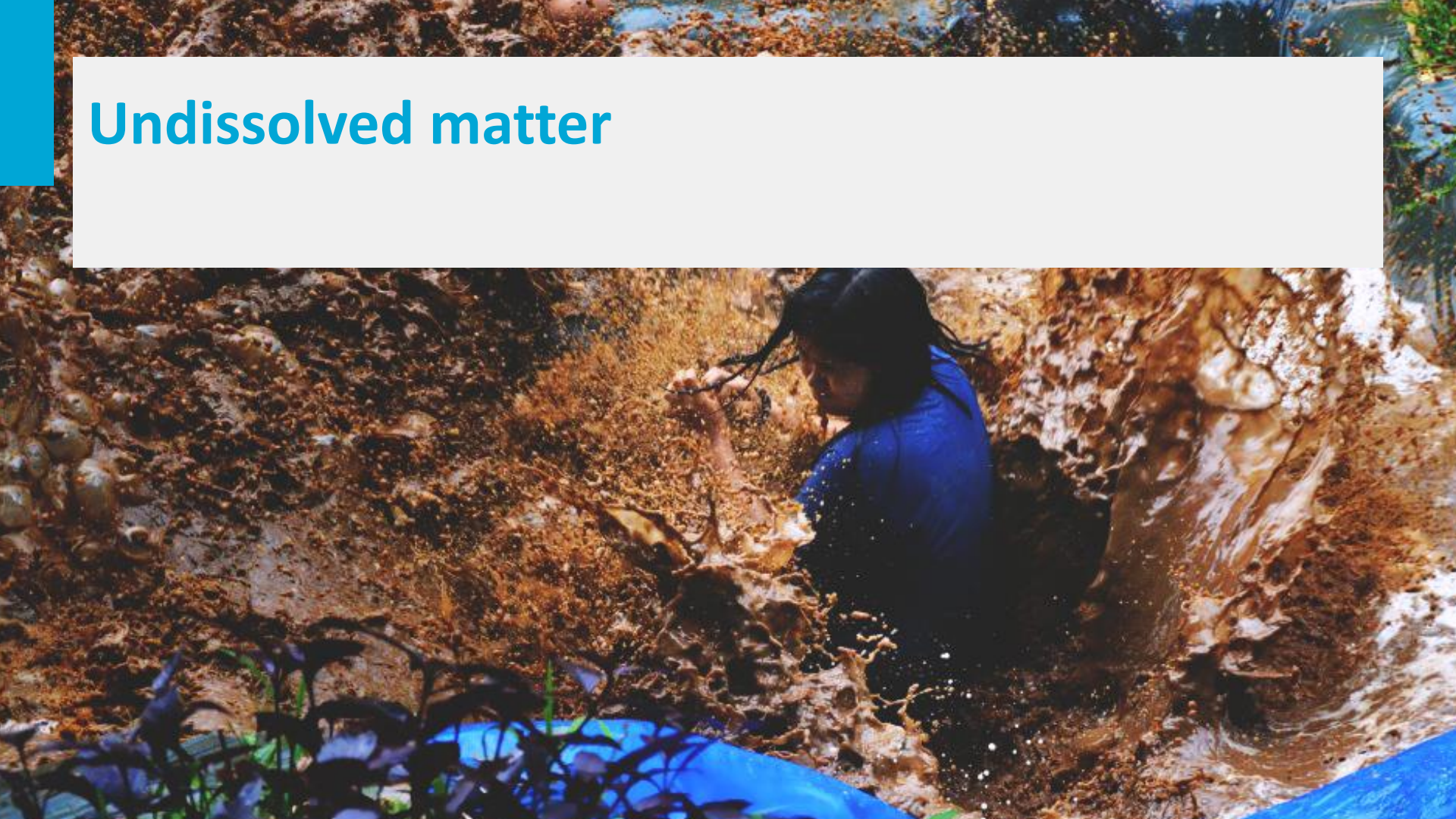
- ***Turbidity***

  FTU (Formazine Turbidity Unit)

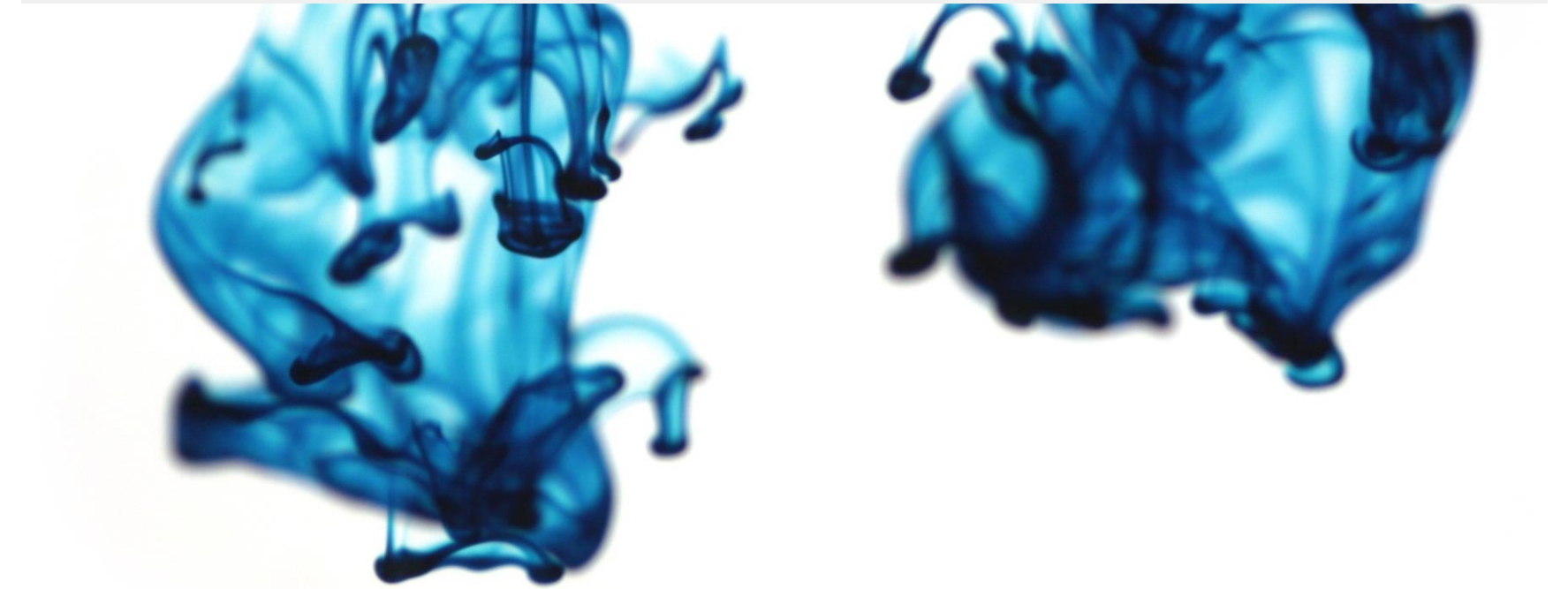
Related measurements

- *Aluminium*
- *Iron*
- *Manganese*
- *Sodium*
- *Sulphate*
- *Zinc*
- *Total suspended solids*

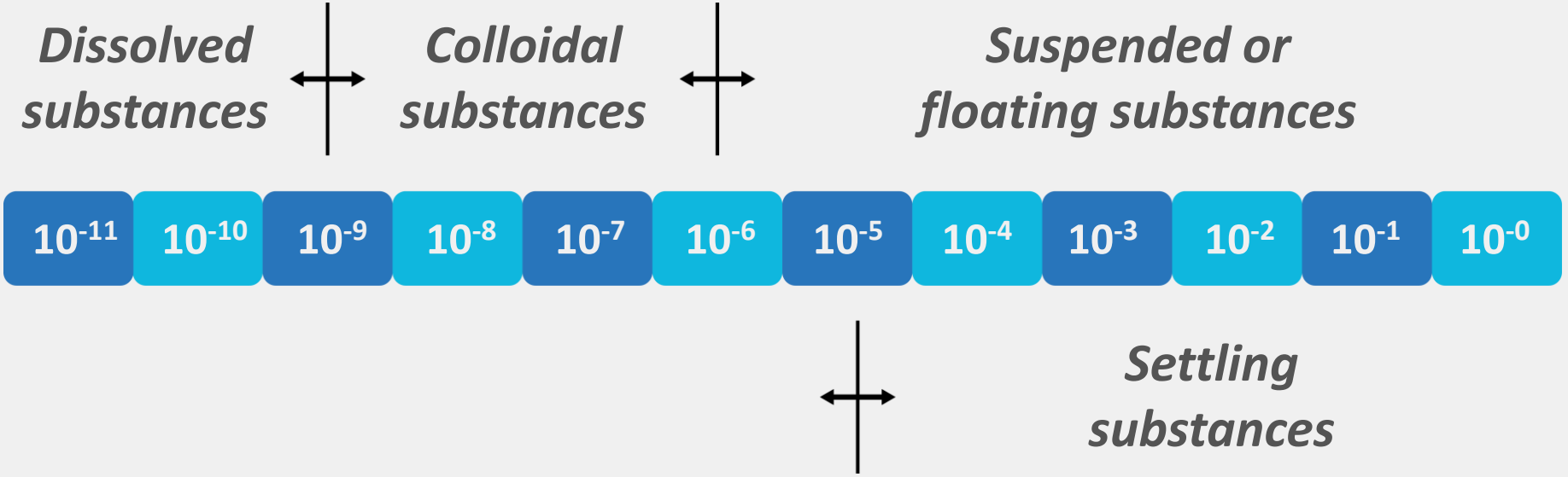
Undissolved matter



Dissolved compounds



Size of substances (m)



Operational parameters

Water quality should not be affected post-treatment through:

- ***Residence time** in **reservoirs** (clean water storage)*
- ***Distribution** to the consumer*
- ***Typical use** within the households (washing, cooking)*

Growth in distribution network

Growth in distribution networks

- ***Organisms*** *(Areomonas, Clostridium perfingens)*
- ***Nutrients*** *(ammonium, AOC)*
- ***Temperature***
- ***HCO_3^- for buffer capacity*** *(CO_2 formation)*
- ***Dissolved oxygen***

Aggressive water

Prevent dissolution of pipe material *(copper, cement)*

- ***Saturation index***
- ***Hardness***
- ***pH***

Hard water

- *Scaling in heating installations*
- *Visible film on tea*
- *Detergent use*

Summary

- *Important **water quality parameters** for safe water supply*
- *Their effect on **health**, **consumer demands** and **operation***
- *Next step: how can **constituents** be **removed** from water?*

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