QUALITY ASSESSMENT OF DIALYSIS WATER

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ABSTRACT

Dialysis water, also known as dialysate, is a special type of water used in the dialysis process. Dialysis is a medical procedure that helps remove waste products and excess fluid from the blood when the kidneys are unable to do the job adequately. Dialysis water is thoroughly purified and treated to ensure its safety and suitability for the dialysis process. It is produced by water purification systems that remove impurities including minerals, bacteria, viruses and other contaminants. The purification process usually involves several steps such as filtration, reverse osmosis and deionization .Two water samples are collected directly from RO plant sources as in WC.R outlet storage tank into one litre Bisleri package water bottle and + clarifications .The method used in lab is **Desired testing tailor test,** .and code package (TTP).The physical attributes and the mineral composition water are under permissible unit as per WHO guidelines. According to Indian government haemodialysis guidelines, acceptable limits of bacterial contamination of treated water and dialysis were considered below 200 CFU/ml and below 2000 CFU/ml, respectively.

KEY WORDS: - Dialysis water, Dialysate, Deionization, RO, Haemodialysis, Contaminants, Bacteriological, Purification.

I. INTRODUCTION

(a) WHAT IS DIALYSIS: -

Dialysis could be a therapeutic treatment that's utilized to expel overabundance waste and liquid from the blood when the kidneys are not working legitimately. The treatment includes employing an uncommon machine to channel the blood exterior the body, expelling squander items and overabundance liquids, and after that returning the sifted blood back to the body

(b) DIALYSIS REQUIREMENTS: -

Dialysis is a cure for renal failure patients that requires constant monitoring and management. A patient with kidney failure is unable for the kidneys to carry out their regular duties, which include eliminating waste and extra fluid from the blood, preserving fluid and electrolyte balance, and generating hormones that control blood pressure and the generation of red blood cells.

(c) FUNCTION OF DIALYSIS: -

Components that are tiny enough to diffuse through the holes are exchanged between two fluids that are separated by a porous membrane during dialysis. Solutes, such as urea and inorganic salts, flow through the sterile solution on the other side of the membrane when blood comes into touch with one side of it. White and red blood cells, proteins, and platelets cannot pass through the barrier due to the size of the particles. Amino acids, carbohydrates, and essential salt concentrations are among the chemicals that are added to a sterile solution to limit or prevent their diffuse loss; as a result, the blood's natural diffusion of these molecules is replaced with a uniform movement in the opposite direction. Absence of chemicals that are diffusible in the blood swapped out for a consistent,

anticlockwise movement. It is possible to make up for the absence of diffusible compounds in the blood by adding them to the solution where they enter the bloodstream.
Since the concentration of water in blood is smaller than that in solution, even if it flows through the membrane with ease, dialysis cannot eliminate it. The tendency is for water to actually enter the blood from the solution.
Ultrafiltration, in which some water and other solutes are driven through the membrane to retain the blood at a pressure higher than the solution, prevents the dilution of blood that arises from this unique process.

(d) TYPES OF DIALYSIS: -
There are three primary and two secondary types of dialysis

DIALYSIS IN PRIMARY PHASE: -
Haemodialysis: -Haemodialysis Using a machine to filter blood outside the body is known as hemodialysate. An excess of fluid and waste products are removed from the patient's blood by filtering it in a dialysis machine during hemodialysate. Via a vein or catheter, the clean blood is then reintroduced into the body. Treated for many hours three times a week, hemodialysate is typically carried out in a hospital or dialysis facility. A) In-centre haemodialysis and B) Home Dialysis are the two forms of haemodialysis.

Peritoneal dialysis (PD):- Patients with severe chronic renal disease can receive therapy with peritoneal dialysis (PD). Dialysis method that makes use of the peritoneum, a tissue found inside the abdominal cavity, as the patient's own filter. There are two varieties of peritoneal dialysis: Continuous cyclic peritoneal dialysis (Cyclic PPD) and Intermittent PPD (IPD).

Hemofiltration Dialysis: - Renal replacement therapy known as hemofiltration is used to treat patients with kidney failure, but it may also be helpful in sepsis or multiple organ dysfunction syndrome. During this procedure, waste and toxins are extracted from the patient's blood by passing it over a semipermeable membrane using a set of tubes and apparatus. The patient's blood is replenished and returned to the body with replacement fluid.

SECONDARY DIALYSIS:-

Haemodialysis: - Haemodiafiltration combined with haemodialysis removes more water from the blood than standard dialysis does. Larger toxin particles that are sometimes not filtered out during regular dialysis are helped to disappear by the procedure. The haemodiafiltration machine removes extra water and toxins, replaces the water with a pure electrolyte solution, and then replenishes the body with the treated blood. hemodiafiltration as a CKD patient's course of treatment. Not only is it a successful treatment for kidney failure, but it can also extend life. Researchers discovered that hemodiafiltration reduced mortality in renal failure patients by 35 percent when compared to non-hemodiafiltration patients in a study presented at the European Association for Dialysis and Transplantation.

Intestinal dialysis: - By including soluble fibre in the diet, such as gum Arabic, intestinal dialysis increases the quantity of nitrogen expelled as fecal waste because the fibre is broken down by the flora in the large intestine. Children with severe chronic kidney disease (CKD) who did not have access to dialysis showed a small decrease in blood BUN levels and a reduction in uremic symptoms when acacia fibre was added to a low-protein diet. Even though it appears to be far less practical than PD or HD, it can nevertheless be useful when resources are scarce.

(e) BENEFITS OF DIALYSIS:-

Removes waste products: Waste products that build up when the kidneys are not functioning properly, such as urea, creatinine, and excess electrolytes, are removed from the body with the use of dialysis.
Maintains fluid balance:- Dialysis assists in removing extra fluid from the body and preserving fluid balance, both of which are critical for renal failure patients who run the risk of developing edema and hypertension.
Relieves symptoms: Dialysis can help with symptoms that may be brought on by renal failure, including nausea, vomiting, exhaustion, and dyspnea.
Improves quality of life: Dialysis can assist people with renal failure maintain their energy, appetite, and sleep patterns, which can enhance their quality of life
Enables flexibility: dialysis can be performed in a variety of locations, including at home, allowing more flexibility and comfort for patients. Helps prolong life: Dialysis can help prolong the lives of patients with kidney failure who would otherwise not survive without it.
In general, dialysis is an effective treatment option for patients with kidney failure and can improve their quality of life and prolong their life.

(f) DISADVANTAGES OF DIALYSIS:-

Time consuming: Dialysis treatment can be time consuming, with each treatment session lasting several hours. Patients may need to plan their lives while on dialysis.

Risk of infection: dialysis requires the use of medical equipment, which increases the risk of infections such as blood infections and peritonitis.

Dietary restrictions: Dialysis patients may need to follow a strict diet to prevent complications such as fluid overload and electrolyte imbalances.

Side effects: Dialysis treatment can cause side effects such as low blood pressure, nausea, seizures and headaches. Emotional impact: Dialysis treatment can be emotionally draining for patients, who may experience depression, anxiety and reduced quality of life.

Expensive: Dialysis treatment can be expensive and may not be covered by insurance or government programs in some countries.

Not all renal failure patients need dialysis, thus it's crucial to remember that each patient's advantages and dangers from treatment must be carefully considered.

(D).Dialysis water:-

During treatment, the liquid that passes through the dialyzer and comes into touch with the patient's blood is called the dialysis solution, which is made using the dialysis water. To guarantee the efficacy and safety of the dialysis process, dialysis water must adhere to harsh purity requirements. Filtration is used to eliminate contaminants such as bacteria, viruses, chemicals, and minerals from dialysis water that could be hazardous to the patient. The standard processing method for obtaining the necessary level of purity involves utilizing a blend of filtration, reverse osmosis, and deionization. When administering dialysis, medical experts closely monitor the precise composition of the solution, which includes the concentrations of different electrolytes and other components, in order to fulfil each patient's unique needs. During dialysis therapy, healthcare professionals closely monitor the specifics of the dialysis solution, such as the concentrations of different electrolytes and other components, based on the needs of each patient. Maintaining an eye on the dialysate's composition can help you achieve the correct electrolyte balance, fluid removal, and waste removal.

(e).Sources of Dialysis Water:

In relation to dialysis, the water used to make dialysate, which is the fluid used in dialysis machines, must meet specific quality standards to ensure patient safety. Here are the most common water sources used in dialysis:

Reverse Osmosis (RO) the most often utilized technique for purifying water in dialysis centres is reverse osmosis. Water is forced through a semi-permeable membrane to eliminate various contaminants such as bacteria, viruses, and minerals. Because of its extreme purity, RO water is regarded as the gold standard for dialysis.

Deionized water: Deionization is another process used to purify dialysis water. It involves removing ions and charged particles from water by passing it through ion exchange resins. Deionized water is often used in conjunction with other purification methods such as carbon filtration or reverse osmosis to achieve the desired water quality.

Distilled Water: Heating water to create steam and allowing it to condense back into a liquid is the process known as distillation. This technique gets rid of germs, minerals, and some pollutants. Though it is less prevalent than RO or deionized water, distilled water can be used for dialysis. No matter what source of water is used, dialysis facilities must adhere to stringent water purification procedures to guarantee that the water meets quality standards established by regulatory organizations like the International Organization for Standardization (ISO) and the Association for the Advancement of Medical Instruments (AAMI). To shield patients from potential injury, these criteria specify the highest quantities of contaminants that are permitted in dialysis water**.**

II.METHODOLOGY

A.SAMPLE COLLECTION:- Water samples are collected directly from the RO plant outlet storage sources as in WCR tank into empty one litre bisleri packaged water bottle and given to laboratory

B.SAMPLE VOLUME: - For most physical and chemical analyses, a one-liter sample will work well, although the amount may need to be adjusted based on the specific analytical method being used, among other factors.

1. Colour is based on 183025 Part-4 platinum cobalt visual comparison, Colourless 0 Hazen Unit (PCU)

2. Odour rating by lab personnel: Odourless, Agreeable or Disagreeable (Unpleasant or Offensive)
3. Turbidity EST, as in 183025P110, using H198703 Nephelo-Turbidimeter. NTU-Nephelometric Turbidity Unit.
4. PH value at 25°C is as measured by Hanna H12002-02Edge (pH) instrument.
5. EC at 25°C measured by Hanna H12003-02EdgeEC. The reference value in this case is as specified by the Central Pollution Control Board (CPCB). TDSE range 0.5EC-0.75EC.

C.BACTERIOLOGICAL ANALYSIS:-TVC pour plate method, using tryptic soya agar, and 48 hours incubation at 35 C to 37 C PHYSICAL AND SENSORY CHARACTERISTICS :-PREPARATION OF MEDIUM FOR BACTERIOLOGICAL ANALYSIS PRESENT IN THE DIALYSIS WATER SAMPLE:-

D. PREPARATION OF REAGENT: - Preparing Reagents Heat BD Tryptic Soy Agar (Bottled Media) in an autoclave or steam cooker to liquefy it. An alternative would be to put the bottle inside a jar filled with water and heat it until it boils on a hot stove. Before heating, slightly loosen the cap to permit pressure exchange.

Warning:-Microwave ovens are not advised for the liquefaction of the medium. Media bottles with metal closures should not be used in microwave ovens.

E.SPECIMEN TYPES: - In several processes, including drug testing, the unsupplemented media is put onto Petri plates. It must be supplemented with blood (e.g., 5% sheep blood) if utilized as an isolation medium for pathogens from clinical specimens in clinical microbiology. The plated medium can be used worldwide for primary isolation of pathogens from all kinds of specimens if it is supplemented with 5% blood. Refer to the references for information on gathering specimens and 4.10 preparation. The tubed, slanted media is meant primarily for the growth and upkeep of bacterial cultures; it is not to be used directly with clinical specimens.

F.TEST PROCEDURE: Agar surfaces of the finished media (in tubes or Petri dishes) should be smooth and damp but not wet, since this could lead to confluent growth, before usage. Refer to the relevant sources for details on certain techniques.25.7
Plates with additional blood added: As soon as the specimen enters the laboratory, it should be streaked. The primary purpose of the streak plate is to separate pure cultures from specimens that include mixed flora. As an alternative, roll the swab over a tiny portion of the surface near the edge if the material is being cultured straight from the swab, and then streak from this infected area. Place the plates or tubes in the appropriate incubator conditions When using it on clinical specimens, incubate at 35 +/- 2° C for 18 to 48 hours (or longer if required), or for as long as the organisms require. For a maximum of five days, incubate at 30 to 35° C if used for hygiene monitoring. See the references if the contents are pharmaceutical in nature Twelve
The bacterial cultures are grown and maintained in tubes using the tilted media. Apply the strain immediately to the entire slanted surface once it has been suspended in sterile water or saline. According to the isolate's needs, incubate. To facilitate venting, caps may be loosened slightly during incubation. Close completely both during storage and after incubation.

G.PERFORMANCE CHARACTERISTICS AND LIMITATIONS OF THE PROCEDURE
Many industrial microbiology processes, such as microbiological limit testing and water and food microbiology, require BD Tryptic Soy Agar. 1367
Numerous less picky bacteria, such as Enterobacteriaceae and nonfermenting Gram negative rods (Pseudomonas and numerous others), are cultivated on unsupplemented Tryptic Soy Agar. Microorganisms that create spores (Bacillus and related genera), enterococci, staphylococci, and other organisms with comparable growth requirements. The medium is not ideal for isolating strict anaerobes that are picky eaters, nor is it appropriate for cultivating or isolating extremely picky bacteria like Neisseria or Haemophilus species, or other organisms with particular dietary needs.. Consequently, its application in clinical microbiology is restricted to specific assays, such as the Haemophilus differentiation using X. V. and XV factors strips.
In clinical microbiology, tryptic soy agar mixed with blood (e.g., 5% sheep blood) is commonly employed as the major isolation medium for aerobic bacteria. See the sources for further information.3, 3, 5.8–10.
Tryptic soy agar without supplements is devoid of substances that actively counteract preservatives or disinfectants. Use Tryptic Soy Agar with Lecithin and Polysorbate or properly supplement the medium if items containing such compounds or previously disinfected surfaces are to be examined.

III. RESULT

A.SAMPLE A (PATIENT A):- The Physical & Sensory characteristics i.e. color, is (<1is), odour is acceptable, Turbidity (0.1) is under permissible levels, pH at 25 C is (6.5) p H value is inacceptable levels and electrical conductivity is 9

The chemical characteristics such as sulphates and nitrate-nitrogen levels is not analysed in the sample.

The Calcium level is observed as 0.40 which is satisfactory

The chemical contamination such as total chlorine is 0.00 which is satisfactory.

The Bacteriological analysis used is TVC which is found to be 7 cfu/ml

B.SAMPLE B (PATIENT B):- The Physical & Sensory characteristics pH at 25 C is 6.3; PH value which is no relaxation; electrical conductivity is 0

The chemical characteristics such as total hardness is below detection level, Calcium

The Bacteriological Analysis used is Total Viable Count (TVC) which is found to be 12 cfu/ml.

IV.CONCLUSION

Based on the results samples were found to be free from contamination. Compare to the two samples, sample B (xyz hospital) is considered to be best for dialysis purpose because it is free from all types of contamination, its physio-chemical characters are under permissible units and is free from any kind of risk factors.

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