The Effectiveness of Reusing Reverse Osmosis Filtered Water in Dialysis Treatment

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Introduction

New Taipei City Hospital (NTCH) is a regional teaching hospital, emergency and critical care hospital in Sanchong District, New Taipei City, Taiwan, serving a population of approximately 600,000 in the Sanchong and Luzhou areas.

Background and Objective

Taiwan has the highest dialysis prevalence rate in the world, with hemodialysis accounting for 90% of all dialysis treatments. Hospitals use reverse osmosis (RO) technology to remove impurities, pollutants, bacteria, and other contaminants from water to produce purified water for use in hemodialysis. The RO reject (ROR) water generated after filtration is discharged without human use; this ROR water is quite clean in quality. Direct discharge is both wasteful and environmentally impactful. Therefore, reusing it is considered to reduce waste and lessen environmental impact.

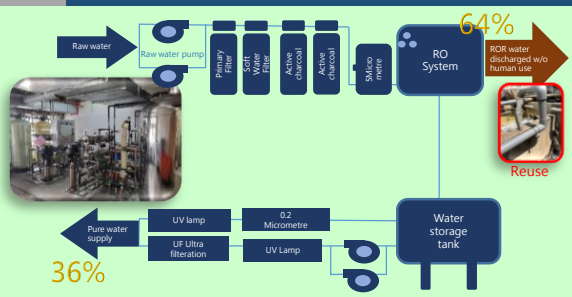

Figure 1. RO System (Pure Water Production Process)

Methods

The hemodialysis center of our hospital (NTCH) requires 17m^3 of purified water daily, generating 29m^3 of discharge water. Annually, 9,000m^3 of water are wasted. Reusing this water could meet the daily needs of 121,600 people and save NT$170,000 per year. Excess recycled water is used for municipal irrigation. NTCH has 5 tanks storing 8m^3 each(2 for cold and 3 for hot water), max. 40m^3. The dialysis center's daily discharge of 29m^3 fits within this capacity. NTCH also switched from natural gas boilers to energy-saving heat pumps, reducing water waste and operating costs.

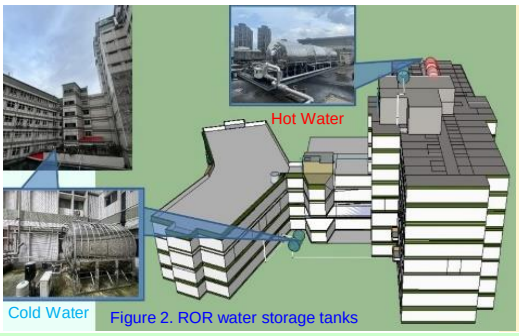

Figure 2. ROR water storage tanks

Figure 3. Replace the boiler with a heat pump

Results

After two years of operation and installation of water meters to record water inflow and recycled water volume, our hospital's overall running water consumption has gradually decreased from 2021 to 2023, and an average annual saving :

1. 2,920m^3 of recycled water for hot water usage
   - Saving NT$58,400 in water fees
   - CO_2 Reducing carbon emissions 604kg
2. 4,800m^3 of recycled water for providing municipal district usage
   - Saving NT$96,000 in water fees
   - CO_2 Reducing carbon emissions 990kg
3. Stop using 29,124m^3 of natural gas
   - Saving NT$321,000 in natural gas fees
   - CO_2 Reducing carbon emissions 60,870kg
4. With an additional electricity consumption of 60,000kWh/year
   - Heating the water during off-peak hours approx. costing NT$114,000
   - CO_2 Increasing carbon emissions 29,700kg

Hence, the annual savings in fuel energy and water fees amount to approximately **NT$361,400** and reducing total carbon emissions by **32,764kg**.

Conclusion

Since 2021, we has been recycling heated water for bathing in the patient wards, and starting in 2024, it has signed a memorandum of cooperation with the municipal district(Sanchong) to provide recycled water for sidewalk tree irrigation and road cleaning.

Figure 4. Heated water for bathing in the wards

Figure 5. For sidewalk tree irrigation and road cleaning

Discussion

Taiwan is ranked as the 18th most water-scarce country in the world. However, it is very unfortunate that dialysis centers discharge large amounts of clean ROR water daily without it being used by humans. For the sake of sustainability and water resource conservation, our hospital would like to share our experience in reusing ROR water. We sincerely welcome visits to observe our current recycling practices.