

NANOMEMBRANE TREATMENT OF BRACKISH WATER IN RURAL AREAS OF NORTH WEST PROVINCE.

By

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2009

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Back ground

- DWAF- NWU collaboration.
- The nitrogenous pollution confirmed
- The highly nitrate-polluted sources were also contaminated with Cl, F, SO₄, Ca and Mg ions.
- **These pollutants are a health risk**
- Membrane technology i.e. NF and RO

South Africa



North West Province



**High nitrate ion concentration; Relatively high population density;
Groundwater the sole source of water; Security considerations for water
treatment plant.**

Membrane

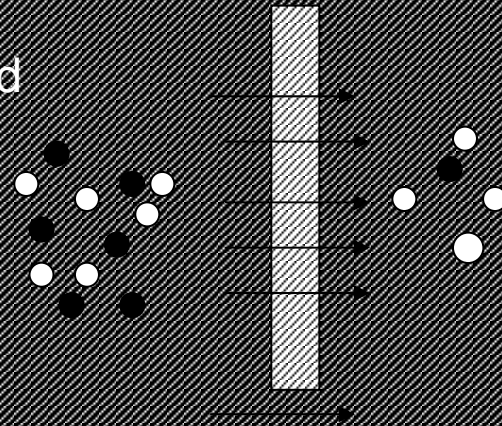
Phase 1

Phase 2

Feed

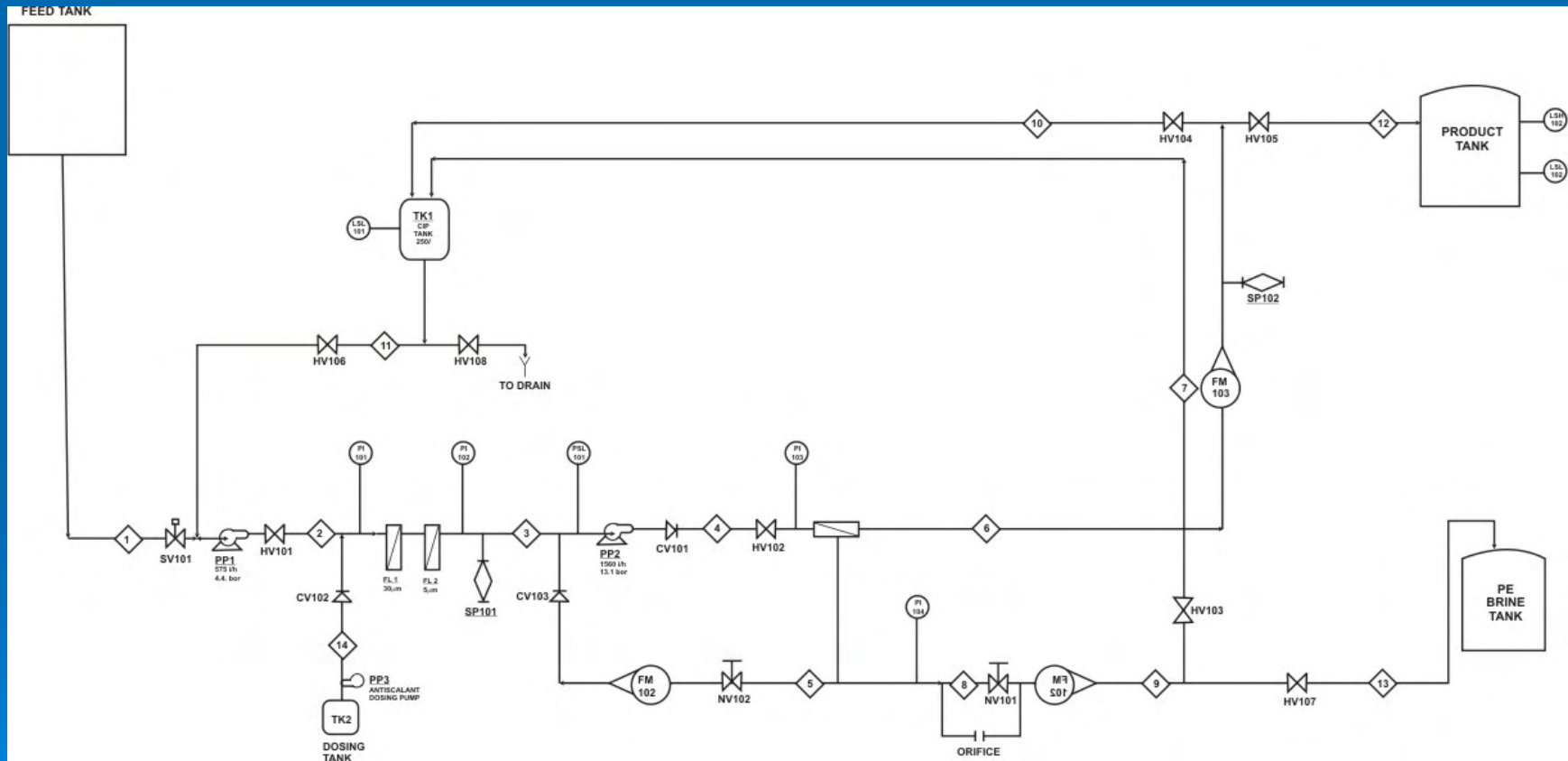
Permeate

Driving force



- A cross-flow module reactor, fitted with a spiral-wound nanomembrane, pilot water treatment plant was set-up (Figure 3);
- The nanomembrane cross-flow reactor was connected to a feed and product water storage tanks;





➤ NF membranes

- (Desal-DL, NF90 and NF270)

➤ RO membranes

- (BW30, S5 and GM)

➤ The determinands were NO₃, Cl, F, SO₄, Ca and Mg.

Table 1: SANS-241 for determinands at Batlhaping Primary School.

Determinand	SANS-241/ppm	Con in ppm
NO3	10	23.6
Cl	200	637
F	1.0	4
SO4	400	110
Ca	150	176
Mg	70	102

Table 2: SANS-241 for physical determinands at Batlhaping Primary School.

Determinand	SANS-241	Physical quality of BPS brackish water
pH	5.0 – 9.5	7.85
EC	<150 $\mu\text{S}/\text{cm}$	229
TDS	<1000 mg/l	91.9

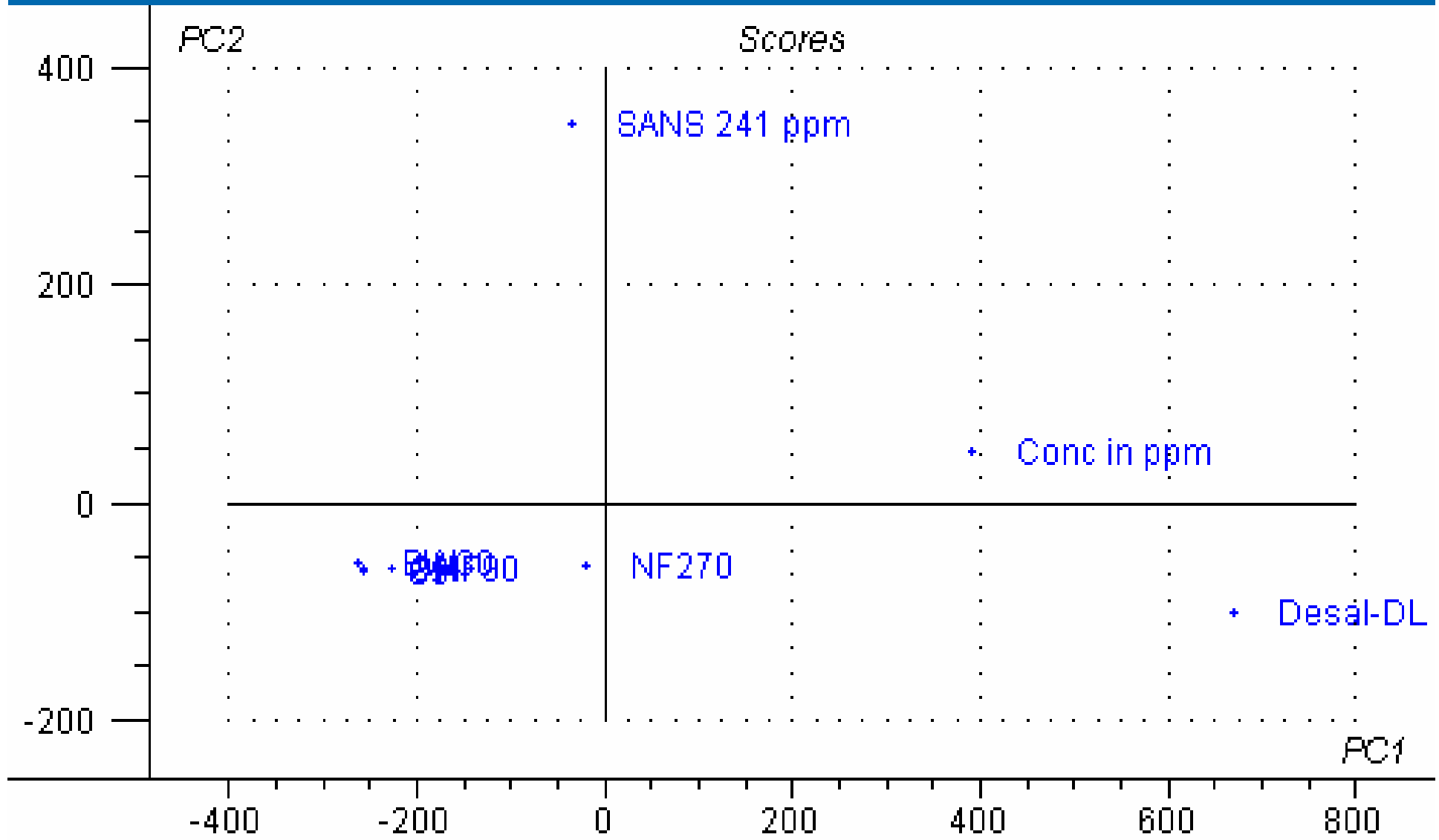
Table 3:Chemical quality of nanomembrane permeate at BPS.

NANOMEMBRANE	NO ₃ /ppm	Cl/ppm	F/ppm	SO ₄ /ppm	Ca/ppm	Mg/ppm
Desal-DL	15.1	393	0.774	10.0	104	56.5
NF270	11.7	246	0.436	6.71	64.6	28.0
NF90	3.19	45.0	0.221	5.39	9.84	5.37
BW30	1.93	10.5	0.108	10.0	2.81	0.50
S5	1.42	17.7	0.163	2.00	2.96	1.50
GM	0.833	15.7	0.239	4.11	4.91	1.69

Table 4: Physical quality of nanomembrane permeate at BPS.

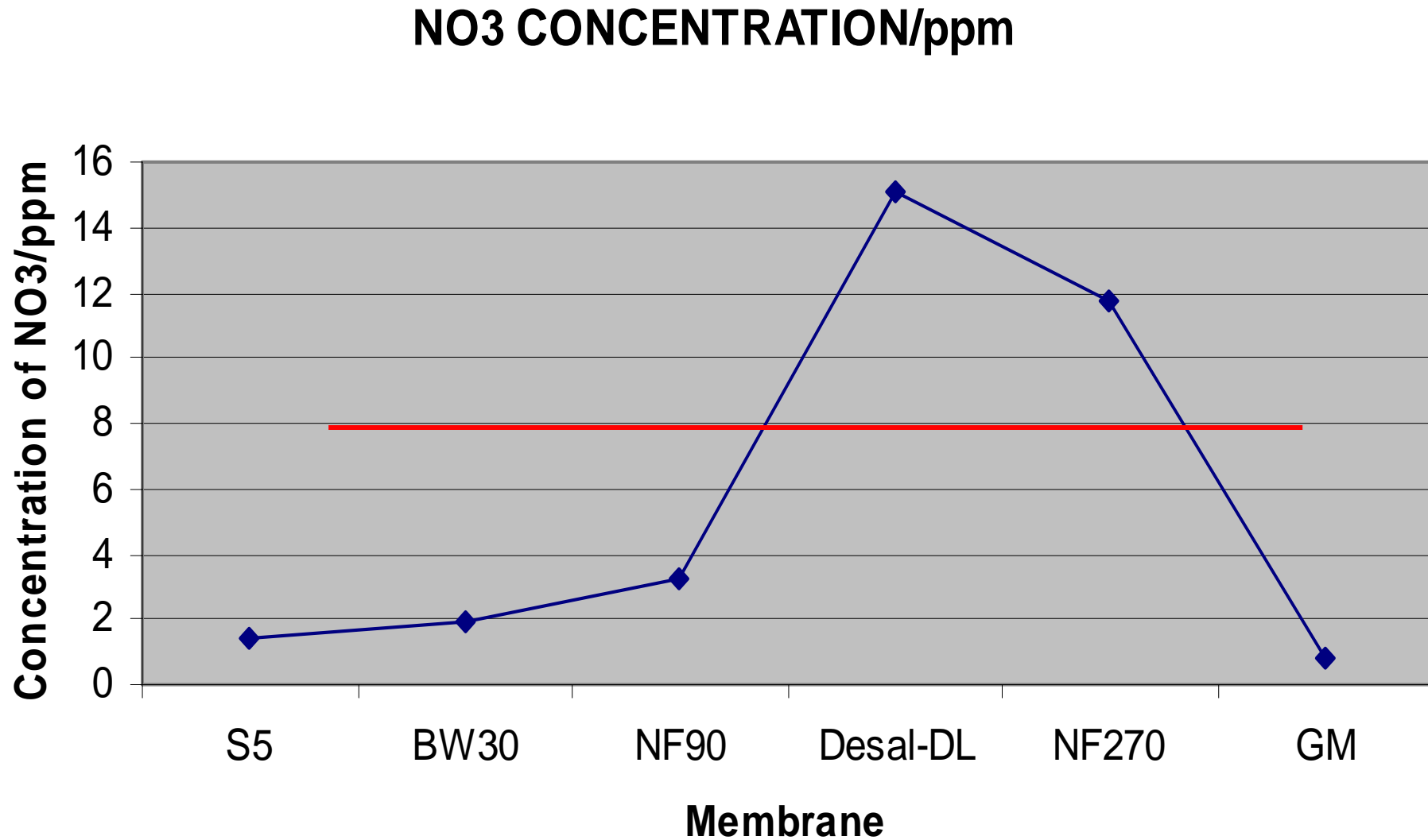
Nanomembrane	pH	EC/ μ S/cm	TDS/mg/l
Desal-DL	8.18	181	72.6
NF270	7.27	113	45.3
NF90	6.81	25.5	10.7
BW30	6.78	7.22	3.03
S5	6.46	10.3	4.33
GM	6.88	6.33	2.66

Figure 4: Multivariate cluster analysis of nanomembrane permeate data.



RESULT1, X-expl: 85%, 15%

Figure 5: A plot of the concentration of NO₃ versus the treatment membranes.



4. CONCLUSIONS

- Nanomembranes Desal-DL and NF270 are not suitable for the treatment of brackish groundwater;
- Nanomembrane which had the highest rejection for all the determinands (except SO₄) was BW30;
- RO membranes virtually removed all the Ca and Mg ions, relative to NF90, from the brackish groundwater;
- NF90 is optimal for brackish groundwater treatment;

WAY FORWARD

- Technologies which do not operate on electricity;
- Methods of treatment which use local materials;
- Water quality education training for rural communities.

5. ACKNOWLEDGEMENTS

- The authors are grateful to the Water Research Commission of South Africa (WRC) without which this research would not have been done;
- The Department of Chemistry, North-West University (Mafikeng campus), is acknowledged for its fiscal and infrastructural support;