# Silt Density Index Test (SDI)

The Silt Density Index (SDI) test is used to determine the fouling potential of water feeding a membrane filtration process such as a reverse osmosis (RO) system. This test is defined by its specific procedure (ASTM D-4189). The ASTM procedure should be referenced for a more detailed description of the procedure.

The SDI test should be run daily on the water entering the RO membranes after the cartridge filters. This frequency can be reduced to weekly once background data proves that less frequent sampling is sufficient. As such, the apparatus should be permanently mounted on the RO machine after the cartridge filters. The test can also be run across vessels such as filters or clarifiers to see if they are doing the job expected of them. SDI tests on the raw supply water should be part of every feasibility study for a RO system and it is good to run one periodically during operation of the system to make sure changes haven't occurred. It is recommended practice to keep a record of SDI values and filters to observe changes over time.

The nature of this test is such that it cannot be run in the laboratory. The apparatus can be purchased as a kit from companies such as Millipore Corporation or it can be assembled as individual components.

## EQUIPMENT REQUIRED

1 – Stopwatch
1 – 500 mL Graduated Cylinder
1 - Thermometer
1 – SDI Testing Assembly Including:
- 1 – ¼ MNPT X ¼ or 3/8 inch Tubing Connector
- 1 – ¼ NPT Ball Valve
- 1 – ¼ NPT Pressure Regulating Valve with Gauge (Set for 30 psi)
- 2 – ¼ inch X short Pipe Nipples
- 1 – 47mm Plastic Membrane Filter Holder.
- 1 – ¼ NPT Hose Adapter
- 1 – Box 47mm, 0.45m Membrane filter
  (Millipore HAWP04700 or HAEP04700 or Equivalent)

**Note:** All wetted components including sample lines to be of stainless steel or plastic construction.

## SDI TEST PROCEDURE

1. Assemble the apparatus as shown in [SDIFigure.vsd] and set the pressure regulator at 207 kPa (30 psi).

2. Flush the assembly and sample lines with sample for 3-5 minutes with water to remove any possible entrained contaminants.

3. Measure the temperature of the water. Set the pressure regulator to 207 kPa (30 psi). The setscrew on the regulator should be adjusted while there is a small flow. Supply pressure to the regulator should be > 276 kPa (40 psi).

4. Open the membrane filter holder and carefully place a 0.45-m membrane filter (47 mm in diameter) shiny side up on the support plate of the holder. Handle the membrane filter only with dull tweezers to avoid puncturing. Avoid touching the membrane with the fingers.

5. Make sure the O-ring is in good condition and properly placed. Replace the top half of the filter holder and close loosely.

6. Bleed out trapped air by cracking the ball valve. Carefully loosen two of the thumbscrews and tilt the holder to be sure all air has been vented from the filter holder. Close the valve and tighten the thumbscrews on the filter holder.

7. Open the ball valve . Simultaneously, using a stopwatch, begin measuring the time required for the flow of 500 ml. Record the time (*ti*). Leave the valve open for continued flow.

8. Measure and record the times to collect additional 500 ml volumes of sample, starting the collection at 5, 10, 15 minutes of total elapsed flow time. Measure the water temperature and check the pressure as each sample is collected. The pressure must remain constant at 30 psi 1 psi and the temperature must remain constant 1o C. This value is recorded as (tf) with f being the time used.

**Note**: Time (*ti*) to collect 500 mL should be within 10% of the time to collect 500 mL using nonplugging reference water at the same water temperature. The nonplugging reference water can be obtained by filtering distilled water through a 0.2-m pore size membrane filter. If *tI* is less than 90% of the nonplugging time, the filter may be cracked and a new filter should be used. If *tI* is more than 110% of the nonplugging time, then a smaller sample size, 250 mL or 100 mL, should be used. SDI values using smaller sample sizes are too high for membrane filter applications.

9. After completion of the test, the membrane filter may be retained for future reference. Record the Date, Sample Location, Time, Operator, SDI Value, and Comments with the filter pad. See the attached form.

## CACULATION

Calculate the silt density index (SDI*T*) as follows*:*

$$SDIT = \frac{[\,1 - ti / tf\,]\,100}{T}$$

Where:

$T$ = total elapsed flow time, minutes (usually 15 minutes).

$t_i$ = initial time required to collect 500 mL of sample

$t_f$ = time required to collect 500 mL of sample after test time $T$ (usually 15 minutes)

**Note:** The expression [ 1 – *ti* / *tf* ] should not exceed 75%. If it does exceed this value, use a shorter time for *T* ; that is 5 or 10 minute measurements. If times shorter than 15 minutes are required, the SDI values are too high for membrane.

Comments on Variability

The procedure outlined must be followed exactly for the information to have meaning and be reproducible. Test variability (50-100%) has been a recognized problem with this method and operator training in procedural details is a critical factor in obtaining precision and accuracy. It is also reported that poor quality hardware can cause extreme variations. Either 316SS or plastic should be used throughout. Keep sample lines short and flush well before running the test. Use only the plastic filter holder as the stainless model is reported to yield results that are both higher on average and have a broader variation. Filter paper batch variations can be significant. Therefore, buying papers in larger quantities of the same batch will provide more consistent results.