Tikrit University

The College of Petroleum Processes Engineering

Petroleum Systems Control Engineering

Department

Petroleum Refining Processes

Fourth Class

Lecture 6

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Ex1: Find the PTB of a crude oil having 10% by volume remnant water if it's concentration is estimated to be 40,000 ppm at 25 C°.

Solution..

① Using (figure 1), the PTB of crude oil having remnant water with 40×10^3 ppm salinity is found to be 14 PTB. For crude oil containing 10 % remnant water obtaind from figure should be multiplied by 100; therefor, the given crude contains 1400 PTB.

or

0.1 %	14 PTB
10 %	X

$X \rightarrow X = \frac{10 * 14}{0.1}$

$= 1400$ PTB

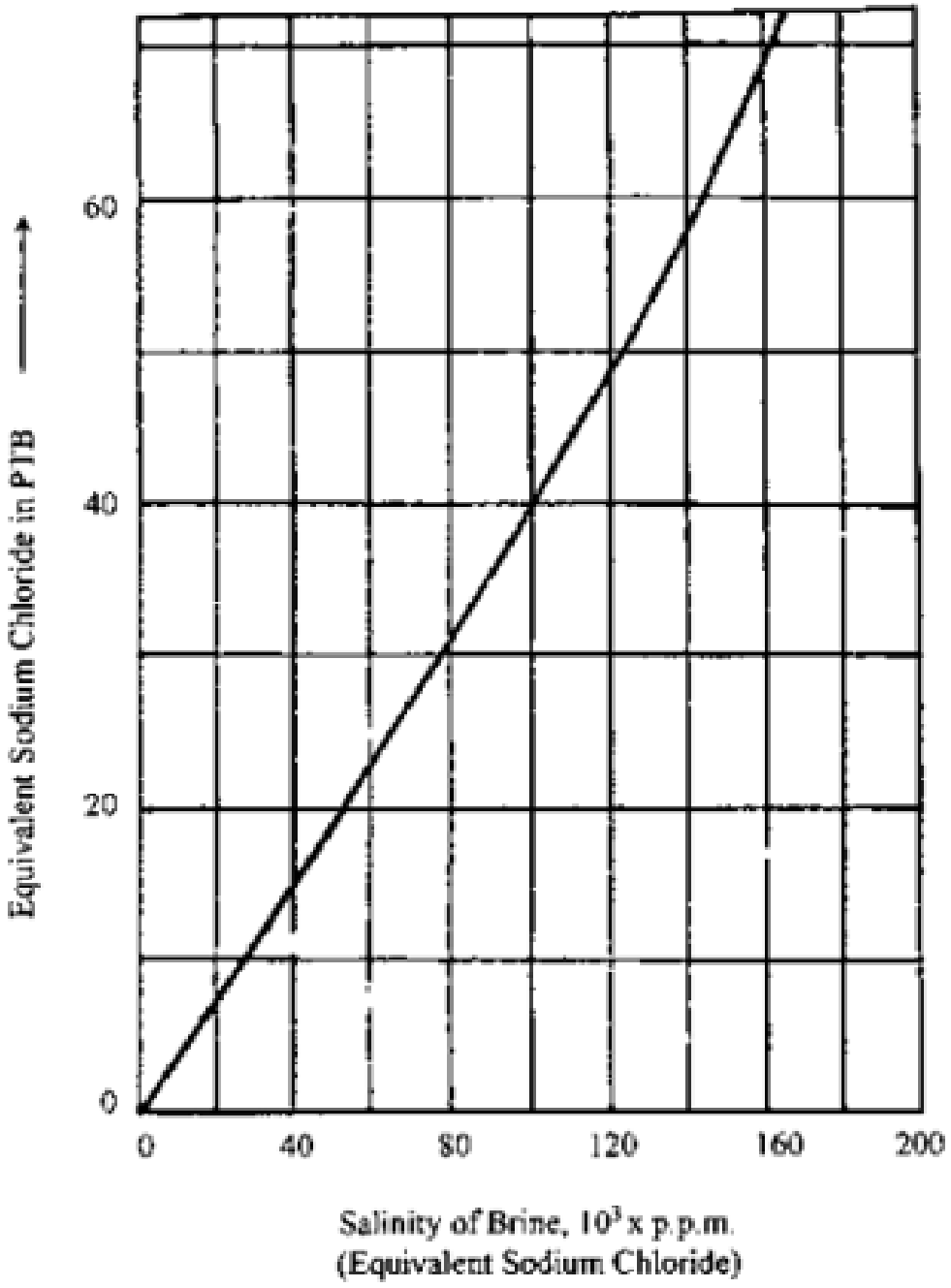

Figure 1: Salt content of crude oil (PTB) as a function of salinity of its remnant water 0.1% (1/1000) by volume remnant water.

(2)

Basis of wet oil = 1000 bbl

B.S & W. (remnant water = 10%.)

Saline water concentration = 40,000 ppm.

40,000 ppm = 4 %

Quantity of water in oil = (1000) * 10/100

= (100 bbl)(5.6 ft³/bbl)

= 560 ft³

1 bbl = 5.6 ft³

Ex

① 300 ppm

X% = 300/1000000 = 0.03%.

② 4000 ppm

4000/1000000 = 0.4%

③ 5 ppm/1000000 = 0.0005%.

by using (Table 1)

at t = 25 C° and 4% conc.

the density of water

is 1.0253 g/cm³ = 63.3787 lb/ft³

mass of water = (560 ft³)(63.3787) lb/ft³

= 35,828 lb

The quantity of Salt found in this mass of water (35828)(40000/1000000) = 1433 lb.

∴ the Salt content is 1433 PTB in 100 bbl.

or (35828) * 4% = 1433 PTB.

Table Densities of Aqueous Inorganic Solutions [Sodium Chloride (NaCl)]

%	0°C	10°C	25°C	40°C	60°C	80°C	100°C
1	1.00747	1.00707	1.00409	0.99908	0.9900	0.9785	0.9651
2	1.01509	1.01442	1.01112	1.00593	0.9967	0.9852	0.9719
4	1.03038	1.02920	1.02530	1.01977	1.0103	0.9988	0.9855
8	1.06121	1.05907	1.05412	1.04798	1.0381	1.0264	1.0134
12	1.09244	1.08946	1.08365	1.07699	1.0667	1.0549	1.0420
16	1.12419	1.12056	1.11401	1.10688	1.0962	1.0842	1.0713
20	1.15663	1.15254	1.14533	1.13774	1.1268	1.1146	1.1017
24	1.18999	1.18557	1.17776	1.16971	1.1584	1.1463	1.1331
26	1.20709	1.20254	1.19443	1.18614	1.1747	1.1626	1.1492

Ex2: find the flow rate of water (m^3/day) which may be used to desalt crude oil 300000 bbl/day (API = 36) ?

Solve

300000 bbl , API = 36

Washing water = 7%

$300000 * \frac{7}{100} = 21000$ bbl/day

$21000 \frac{bbl}{day} * \frac{159\,L}{1bbl} = 3339000$ L/day

1bbl = 159 L

$3339000 \frac{L}{day} * \frac{1\,m^3}{1000\,L} = 3339 \frac{m^3}{day}$

petroleum Refining Processes

API of Crude oil	Washing wate %	Temp (C)
Light crude oil > 40	4 %	40 C
Medium 30-40	7%	50 C
Heavy < 30	10%	60 C