WOIL plot

The plot of WOR (along y-axis) against the inverse oil production rate q_O (along x-axis) (see **Fig. 1**).

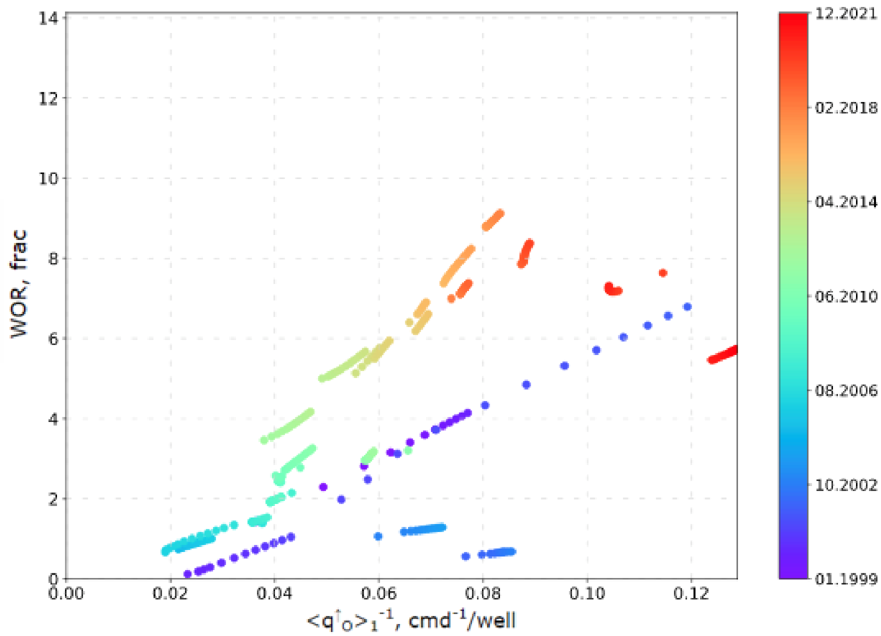

Fig. 1. WOR (logarithmic vertical axis) vs inverse oil production rate (linear horizontal axis)

It can be used for express Watercut Diagnostics of thief water production.

The mathematical model of the thief water production from aquifer is based on the following equation:

(1) $WOR = \frac{q_W}{q_O} = a + b \cdot q_O^{-1}$	(2) $a = J_{1O}^{-1} \cdot (J_{1W} + J_{2W})$	(3) $b = J_{2W} \cdot (p_2^* - p_1^*)$

where

		q_W	water production rate	q_O	oil production rate
p_1^*	formation pressure in petroleum reservoir	J_{1W}	water productivity index of petroleum reservoir	J_{1O}	oil productivity index of petroleum reservoir
p_2^*	formation pressure in aquifer	J_{2W}	water productivity index of aquifer		

For the case of aquifer pressure is higher than that of petroleum reservoir: $b > 0 \Leftrightarrow p_2^* > p_1^*$

For the case of aquifer pressure is lower than that of petroleum reservoir: $b < 0 \Leftrightarrow p_2^* < p_1^*$

In practical applications, the equation (1) is often considered through the weighted average values:

(4) $$\langle WOR \rangle = \frac{\langle q_W \rangle}{\langle q_O \rangle} = a + b \cdot \langle q_O^{-1} \rangle$$

where

$\langle q_W \rangle$, $\langle q_O \rangle$	are weighted average of q_W and q_O

There are different ways to calculate weighted average of the dynamic variable, for example:

t-weighted average	**q-weighted**
$\langle A \rangle_t = \frac{1}{t} \int_o^t A(t)\, dt$	$\langle A \rangle_q = \frac{1}{Q(t)} \int_o^t A(t)\, q(t)\, dt$

See Also

Petroleum Industry / Upstream / Production / Subsurface Production / Field Study & Modelling / Production Analysis / Watercut Diagnostics

References

Chan, K. S. (1995, January 1). Water Control Diagnostic Plots. Society of Petroleum Engineers. doi:10.2118/30775-MS