Oil Neutralisation: Caustic for FFA and Acid Value

Caustic soda (as 100 % and as lye) to neutralise the free fatty acids of a crude oil (as oleic acid) with an excess, the soap formed, and acid value from FFA.

Method: Definitions and mass and energy balances: RCOOH + NaOH → RCOONa + H_2O with FFA as oleic acid ($C_{18}H_{34}O_2$); IUPAC masses

Input parameters

Unit system: SI

Parameter	Value	Unit
Crude oil	50,000	kg
Free fatty acids (as oleic)	2.0000	%
Excess caustic (share of theoretical)	15.000	%
Lye strength (NaOH by mass)	16.000	%

Calculated results

Parameter	Value	Unit
Acid value (mg KOH/g)	3.9725	
Theoretical NaOH	141.60	kg
NaOH with excess	162.84	kg
Lye	1,017.7	kg
Sodium soap formed	1,077.8	kg

Notes for this case

- High-FFA oils (above about 5 %) lose too much neutral oil in soapstock; physical refining (steam stripping of FFA) suits them better.
- The soap is sodium oleate only; the neutral oil entrained in the soapstock (the refining loss) is extra and is not estimated here.

Formula and method

$$m_{th} = \frac{M\,FFA}{M_{oleic}} M_{NaOH}, \quad AV = FFA \cdot 1000 \frac{M_{KOH}}{M_{oleic}}$$

Variables

M	Crude oil	kg
FFA	Free fatty acids (as oleic)	-
x	Excess caustic (share of theoretical)	-
c_l	Lye strength (NaOH by mass)	-
AV	Acid value (mg KOH/g)	-
m_{th}	Theoretical NaOH	kg
m_{NaOH}	NaOH with excess	kg
m_{lye}	Lye	kg
m_{soap}	Sodium soap formed	kg

Method and standards

Neutralisation stoichiometry.

Assumptions and limits

- FFA as oleic acid.
- The soap mass is sodium oleate only; neutral oil carried into the soapstock (refining loss) is not estimated.

References

• Definitions and mass and energy balances: RCOOH + NaOH → RCOONa + H_2O with FFA as oleic acid ($C_{18}H_{34}O_2$); IUPAC masses

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/textile-rice-oil/oil-neutralisation-caustic

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Reopens the calculator with the inputs of this report.