Phosphoric Acid Dose for Juice Clarification

Phosphoric acid to raise juice P_2O_5 to a target, as P_2O_5 added, pure H_3PO_4 and commercial acid by mass and volume, by stoichiometry.

Method: Stoichiometry $P_2O_5 + 3\ H_2O \rightarrow 2\ H_3PO_4$ with IUPAC atomic masses

Input parameters

Unit system: SI

Parameter	Value	Unit
Juice flow	250.00	m³/h
Target P_2O_5 in juice	300.00	mg/L
P_2O_5 already in juice	150.00	mg/L
Acid strength (H_3PO_4 mass fraction)	85.000	%
Acid density Density of the acid at the strength entered (85 % acid is about 1 685 kg/m³); it is not derived from the strength, so change both together.	1,685.0	kg/m³

Calculated results

Parameter	Value	Unit
P_2O_5 added	37.500	kg/h
Pure H_3PO_4	51.778	kg/h
Commercial acid	60.916	kg/h
Commercial acid volume	36.152	L/h

Formula and method

$$\dot{m}_{H_3PO_4} = \dot{m}_{P_2O_5} \frac{2M_{H_3PO_4}}{M_{P_2O_5}}, \quad \dot{m}_a = \frac{\dot{m}_{H_3PO_4}}{w}$$

Variables

$\dot{V}_j$	Juice flow	m³/s
c_t	Target P_2O_5 in juice	kg/m³
c_0	P_2O_5 already in juice	kg/m³
w	Acid strength (H_3PO_4 mass fraction)	-
ρ_a	Acid density	kg/m³
$\dot{m}_{P_2O_5}$	P_2O_5 added	kg/s
$\dot{m}_{H_3PO_4}$	Pure H_3PO_4	kg/s
$\dot{m}_a$	Commercial acid	kg/s
$\dot{V}_a$	Commercial acid volume	m³/s

Method and standards

Stoichiometry.

Assumptions and limits

- Uniform juice flow.
- P_2O_5 concentrations are mg per litre of juice; ppm by mass is lower by the juice density (about 1.06).
- The acid density is entered separately and must match the acid strength.

References

- Stoichiometry $P_2O_5 + 3\ H_2O \rightarrow 2\ H_3PO_4$ with IUPAC atomic masses

Report details

Report reference	FCC-DH3P-NYBS (the same inputs always give the same reference)
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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

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

This calculator online

https://calc.firecad.com/sugar-ethanol/clarification/phosphate-dose-clarification

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.