Ethanol Yield from Grain (Starch Basis)

Ethanol per tonne of grain and per day from starch content, starch-to-glucose conversion (×1.111), saccharification, fermentation and distillation efficiencies.

Method: Starch hydrolysis $(C_6H_{10}O_5)$ + n H_2O → n $C_6H_{12}O_6$ (×1.111) and Gay-Lussac stoichiometry $C_6H_{12}O_6$ → 2 C_2H_5OH + 2 CO_2 with IUPAC atomic masses; ethanol density 789.24 kg/m³ at 20 °C (OIML R 22)

Input parameters

Unit system: SI

Parameter	Value	Unit
Starch % grain (as received)	62.000	%
Starch conversion (liquefaction and saccharification)	96.000	%
Fermentation efficiency	91.000	%
Distillation efficiency	98.500	%
Grain processed	250.00	t/d
Ethanol density at 20 °C	789.24	kg/m³

Calculated results

Parameter	Value	Unit
Glucose per tonne of grain	661.33	kg/t
Ethanol per tonne of grain	384.13	L/t
Ethanol per day (absolute)	96.032	kL/d

Formula and method

$$G = S\eta_s \frac{M_{C_6H_{12}O_6}}{M_{C_6H_{10}O_5}}, \quad y = G\frac{2M_{EtOH}}{M_{C_6H_{12}O_6}}\frac{\eta_f\eta_d}{\rho_e}$$

Variables

S	Starch % grain (as received)	-
η_s	Starch conversion (liquefaction and saccharification)	-
η_f	Fermentation efficiency	-
η_d	Distillation efficiency	-
$\dot{m}_g$	Grain processed	kg/s
ρ_e	Ethanol density at 20 °C	kg/m³
G	Glucose per tonne of grain	kg/kg
y	Ethanol per tonne of grain	m³/kg
$\dot{V}_e$	Ethanol per day (absolute)	m³/s

Method and standards

Stoichiometry.

Assumptions and limits

- Starch fully fermentable after hydrolysis.

References

• Starch hydrolysis $(C_6H_{10}O_5)$ + n H_2O → n $C_6H_{12}O_6$ (×1.111) and Gay-Lussac stoichiometry $C_6H_{12}O_6$ → 2 C_2H_5OH + 2 CO_2 with IUPAC atomic masses; ethanol density 789.24 kg/m³ at 20 °C (OIML R 22)

Report details

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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/ethanol/grain-ethanol-yield

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.