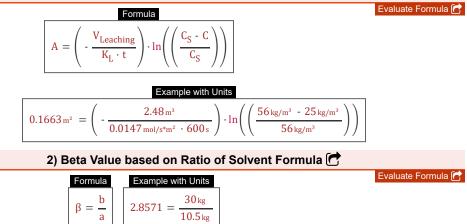
Important Formulas in Solid-Liquid Extraction PDF





3) Concentration of Solute in Bulk Solution at Time t for Batch Leaching Formula

Formula
 Evaluate Formula

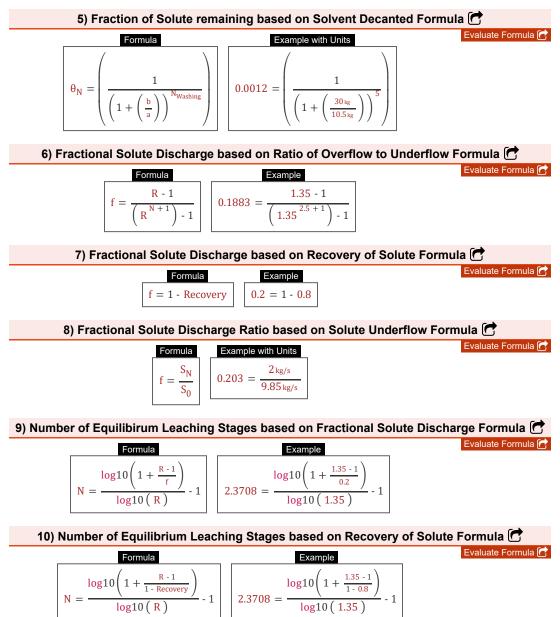
$$C = C_{S} \cdot \left(1 - exp\left(\frac{-K_{L} \cdot A \cdot t}{V_{Leaching}}\right)\right)$$
 Example with Units

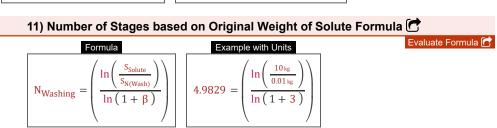
 23.6162 kg/m³ = 56 kg/m³ · $\left(1 - exp\left(\frac{-0.0147 \text{ mol/s}^*m^2 \cdot 0.154 \text{ m}^2 \cdot 600 \text{ s}}{2.48 \text{ m}^3}\right)\right)$

4) Fraction of Solute as Ratio of Solute Formula

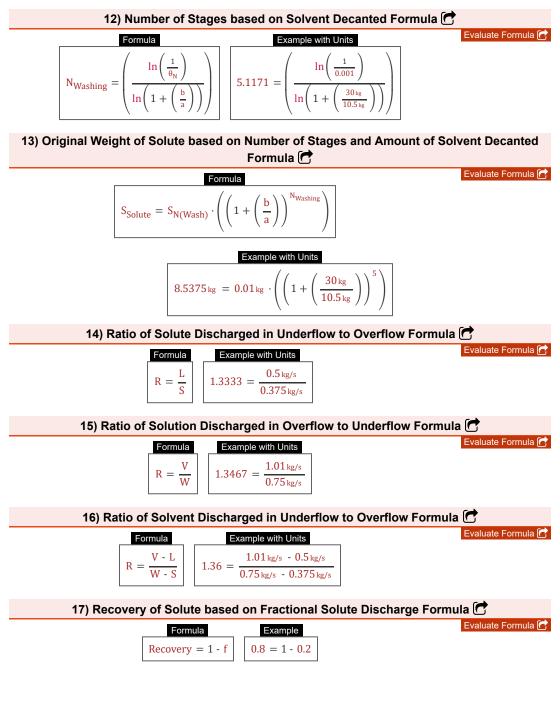


Evaluate Formula











	5
Formula Example with Units	Evaluate Formula 🕝
Recovery = $1 \cdot \left(\frac{S_N}{S_0}\right)$ $0.797 = 1 \cdot \left(\frac{2 \text{ kg/s}}{9.85 \text{ kg/s}}\right)$	
3) Solute Discharged in Overflow based on Ratio of Overflow to Underflow	and Solution

Discharged Formula 🕝

Formula	Example with Units	Evaluate Formula 🕝
$\mathbf{L} = \mathbf{V} - \mathbf{R} \cdot \left(\mathbf{W} - \mathbf{S} \right)$	$0.5037{}_{kg/s}~=~1.01{}_{kg/s}~-~1.35\cdot\left(~0.75{}_{kg/s}~-~0.375{}_{kg/s}~\right)$	

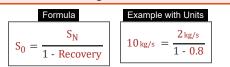
20) Solute Discharged in Underflow based on Ratio of Overflow to Underflow and Solution Discharged Formula

FormulaExample with UnitsEvaluate Formula
$$S = W - \left(\frac{V - L}{R}\right)$$
 $0.3722 \, \text{kg/s} = 0.75 \, \text{kg/s} - \left(\frac{1.01 \, \text{kg/s} - 0.5 \, \text{kg/s}}{1.35}\right)$

21) Solute Underflow Entering Column based on Ratio of Overflow to Underflow Formula 🕝

FormulaExample with Units
$$S_0 = \frac{S_N \cdot \left(\left(R^{N+1} \right) \cdot 1 \right)}{R \cdot 1}$$
 $10.6211 \, \text{kg/s} = \frac{2 \, \text{kg/s} \cdot \left(\left(1.35^{2.5+1} \right) \cdot 1 \right)}{1.35 \cdot 1}$

22) Solute Underflow Entering Column based on Recovery of Solute Formula 🕝 🚽



23) Solute Underflow Leaving Column based on Ratio of Overflow to Underflow Formula 🕝

Formula	Example with Units
$S_{N} = \frac{S_{0} \cdot (R - 1)}{(R^{N+1}) - 1}$	$1.8548 \text{kg/s} = \frac{9.85 \text{kg/s} \cdot (1.35 - 1)}{(1.35^{2.5 + 1}) - 1}$

24) Solute Underflow Leaving Column based on Recovery of Solute Formula 🗹 👘

FormulaExample with UnitsEvaluate Formula
$$S_N = S_0 \cdot (1 - Recovery)$$
 $1.97 kg/s = 9.85 kg/s \cdot (1 - 0.8)$



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Evaluate Formula

Evaluate Formula

Evaluate Formula

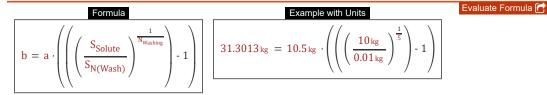
25) Solution Discharged in Overflow based on Ratio of Overflow to Underflow and Solute Discharged Formula

Formula	Example with Units	Evaluate Formula
$\mathbf{V} = \mathbf{L} + \mathbf{R} \cdot (\mathbf{W} - \mathbf{S})$	$1.0062 \text{kg/s} = 0.5 \text{kg/s} + 1.35 \cdot \left(0.75 \text{kg/s} - 0.375 \text{kg/s} \right)$	

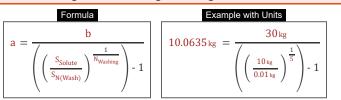
26) Solution Discharged in Underflow based on Ratio of Overflow to Underflow and Solute Discharged Formula

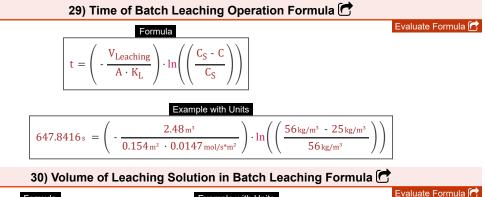


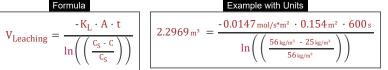
27) Solvent Decanted based on Original Weight of Solute and Number of Stages Formula 🕝



28) Solvent Remaining based on Original Weight of Solute and Number of Stages Formula 🕝





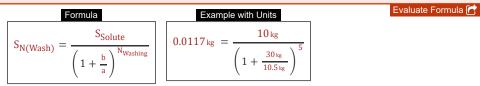




Evaluate Formula 🦳

Evaluate Formula 🦳

31) Weight of Solute remaining based on Number of Stages and Amount of Solvent Decanted Formula 🕝





Variables used in list of Important Formulas in Solid-Liquid Extraction above

- a Amount of Solvent Remaining (Kilogram)
- A Area of Leaching (Square Meter)
- **b** Amount of Solvent Decanted (Kilogram)
- C Concentration of Solute in Bulk Solution at Time t (*Kilogram per Cubic Meter*)
- C_S Concentration of Saturated Solution with Solute (Kilogram per Cubic Meter)
- f Fractional Solute Discharge
- K_L Mass Transfer Coefficient for Batch Leaching (Mole per Second Square Meter)
- L Amount of Solute Discharge in Overflow (Kilogram per Second)
- N Number of Equilibrium Stages in Leaching
- N_{Washing} Number of Washings in Batch Leaching
- R Ratio of Discharge in Overflow to Underflow
- Recovery Recovery of Solute in Leaching
 Column
- **S** Amount of Solute Discharge in Underflow (Kilogram per Second)
- S₀ Amount of Solute in Underflow Entering Column (Kilogram per Second)
- S_N Amount of Solute in Underflow Leaving Column (Kilogram per Second)
- S_{N(Wash)} Weight of Solute remaining in Solid after Washing (*Kilogram*)
- S_{Solute} Original Weight of Solute in Solid (*Kilogram*)
- t Time of Batch Leaching (Second)
- V Amount of Solution Discharge in Overflow (Kilogram per Second)
- V_{Leaching} Volume of Leaching Solution (Cubic Meter)
- W Amount of Solution Discharge in Underflow (Kilogram per Second)
- β Solvent Decanted per Solvent Remaining in Solid

Constants, Functions, Measurements used in list of Important Formulas in Solid-Liquid Extraction above

- Functions: exp, exp(Number)

 n an exponential function, the value of the
 function changes by a constant factor for every
 unit change in the independent variable.
- Functions: In, In(Number) The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- Functions: log10, log10(Number) The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.
- Measurement: Weight in Kilogram (kg) Weight Unit Conversion
- Measurement: Time in Second (s)
 Time Unit Conversion
- Measurement: Volume in Cubic Meter (m³) Volume Unit Conversion
- Measurement: Area in Square Meter (m²) Area Unit Conversion
- Measurement: Mass Flow Rate in Kilogram per Second (kg/s)
 Mass Flow Rate Unit Conversion
- Measurement: Mass Concentration in Kilogram per Cubic Meter (kg/m³) Mass Concentration Unit Conversion

+ $\, \theta_{N}$ Fraction of Solute Remaining in Solid



Important Counter Current Continuous Solvent) Formulas
 Leaching for Constant Overflow (Pure

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Simple fraction C

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