

#### 9.4.4 Process Terminology

##### **Back extraction**

A synonym for *stripping* (by extraction).

##### **Back Washing**

Often used as a synonym for *stripping*. This term is not recommended.

##### **Continuity Inversion**

A change in the mutual dispersion of two phases in contact. See *Inversion*.

##### **Continuous Multistage Contactor**

See *Stagewise Contactor*.

##### **Crowding**

The displacement of an impurity from an extract phase by contact with a solution containing the main extractable solute. See *Scrubbing*, *Exchange extraction*.

*Note:* The main solute need not be present in a pure solution but should have a higher *distribution ratio* than the impurities present.

##### **Crud**

A deposit or emulsion at the interface between two partially settled phases.

*Notes:*

- (i) The phenomenon of crud formation arises from many causes and this definition does not imply any single one.
- (ii) Other terms - some unprintable - have been used but *crud* is the generally accepted term.

##### **Density Inversion**

The interchange of the denser and less dense phases due to changes in solute concentration. See *Inversion*.

*Note:* *Phase inversion* is often used in this context but is ambiguous.

##### **Differential Contactor**

A type of continuous multistage extraction equipment in which there is only one interface at which phase separation by settling occurs. See *Theoretical stage*.

### **Exchange Extraction**

An extraction operation or process in which a metal from one phase is exchanged with the equivalent amount of a second metal from the other phase. See *Crowding*.

*Note:*

- (i) This term may be used in connection with any step (e.g. *loading*, *scrubbing* or *stripping* in a process).
- (ii) This applies also to organic or molecular species.

### **Extraction (in process liquid-liquid distribution)**

In connection with processes, this term often refers to the initial transfer step whereby the *main solute*, often together with impurities, is transferred from *feed* to *solvent*. See *Loading*.

*Notes:*

- (i) *Partition* and *distribution* are not synonyms in this specific instance.
- (ii) The term *extraction* may be used in a more general sense. See under "General Definitions" (9.4.1).

### **Extraction Isotherm**

See *Distribution isotherm*.

### **Feed**

A solution introduced into an *extraction* system.

*Note:* It should be clearly identified (e.g. *scrub feed*) but, if used without qualification, it may be taken to designate the initial liquid phase containing the main solute to be transferred.

### **Height Equivalent to a Theoretical Stage (HETS)**

See explanation of *Theoretical Stage*.

### **Inversion (or Phase Inversion)**

This term is used in two senses which should be specified.

- (i) **density inversion**
- (ii) **continuity inversion**

### **Load (in liquid-liquid distribution) (Verb)**

To transfer solute from a *feed* to another liquid phase.

### **Loaded Solvent**

See *Extract*.

*Note:* This term is usually used to denote the *extract* after completion of a particular step, e.g. *extraction* or *scrubbing*.

### **Loading (Noun)**

The concentration of an extracted solute in the *extract*.

### **Loading (Verb)**

See *Load*.

*Note:* Used in this sense the term normally refers to the operation of transferring the *main solute*, often with impurities from the *feed* to the *solvent*.

### **O.K. Liquor**

Sometimes used as a synonym for *strip product solution* or *strip liquor*.

*Note:* This term is confusing and *should not* be used.

### **Operating Line**

A graphical representation of the mass balance relationship of a solute across an extraction process *step* or *stage*.

### **Phase Inversion**

See *Density inversion*.

### **Raffinate**

The phase remaining after extraction of some specified solute(s). When necessary it should be further specified, e.g. *scrub raffinate*.

*Note:* The original meaning of *raffinate* as a "refined product" has become extended and changed by common usage.

The term should normally be applied only to waste streams but the latter may form the feed to a further extraction process for another solute.

### **Regeneration**

See *Solvent regeneration*.

### **Scrubbing**

See *Crowding* and *Selective stripping*.

The process of selectively removing contaminating solutes (impurities) from an *extract* that contains these as well as the *main extractable solute* by treatment with a new immiscible liquid phase.

*Note:* The term *stripping* has a different meaning and should not be used in this sense although this usage has been customary in certain industries.

### **Scrubbing Agent**

The chemical reagent used to effect *scrubbing*.

*Note:* Often used as a synonym for its solution.

### **Scrubbing Agent Solution**

The solution used to effect *scrubbing*.

*Note:* The term *scrub solution* is ambiguous and is not recommended.

### **Scrubbing Isotherm**

See *Distribution isotherm*.

### **Scrub Feed**

The *extract* to be scrubbed.

### **Scrub Liquor**

See *Scrub raffinate*.

*Note:* This term is ambiguous and is not recommended.

### **Scrub Product Solution**

The solution that results from the *scrubbing* of impurities from an extract phase.

*Note:* The term *scrub liquor* is also used but can be confused with the *scrubbing agent* solution and is not recommended. See *Scrub raffinate*.

### **Scrub Raffinate**

This term should only be used where the product solution from scrubbing is discharged to waste. *Scrub product solution* is better where this stream is combined with *feed* to the loading section.

### **Scrubbing Ratio**

See *Distribution ratio*.

*Note:* The term *scrubbing coefficient* is not recommended. This term is not common.

### **Scrub Solution**

See *Scrubbing agent solution*.

*Note:* This term should not be used as it is ambiguous and can be confused with *scrub raffinate* or *scrub product solution*.

### **Selective Scrubbing**

See *Stripping*.

### **Solvent Inventory**

The total quantity of solvent present in the process.

### **Solvent Loss**

The total quantity of solvent lost during the operation of a process.

*Note:* There are a number of ways currently in use to express both *solvent inventory* and *solvent loss* and authors should carefully define how they are using the terms until a generally agreed procedure can be recommended.

### **Solvent Purification**

See *Solvent regeneration*. The description *solvent purification* naturally applies also to the purification of fresh *solvent*.

### **Solvent Regeneration**

Treatment of the solvent for re-cycling, e.g. by removal of degradation products or non-strippable solutes.

*Note:* The term *solvent purification* is synonymous, but the terms *scrubbing*, *stripping* and *washing* should not be used in this context.

### **Stage**

That physically distinct part of an extraction process in which transfer of solute(s) occurs, followed by phase separation. See *Theoretical stage*.

*Notes:*

- (i) For certain types of equipment with a single phase separation interface, the term *theoretical stage* is more appropriate.
- (ii) Equilibrium need not necessarily be established in a *stage*.

### **Stagewise Contactor**

A type of continuous multi-stage liquid-liquid contactor in which each stage has a physically distinct cycle of interphase contact and separation.

*Note:* There will be the same number of phase separation interfaces as there are stages.

### **Steady State (in liquid-liquid distribution)**

The state of a continuous process when it is operating in such a way that the concentration of solutes in exit streams remains constant with respect to time for constant feed concentrations, even though the two phases are not necessarily in thermodynamic equilibrium in any part of the process.

*Note:* The term *equilibrium* should not be used to describe this situation.

### **Step (in liquid-liquid distribution)**

That operation in an overall extraction process in which transfer of solute(s) occurs in a particular direction, e.g. *Loading*, *stripping*, *scrubbing*.

### **Strip Liquor**

A liquid phase resulting from the operation of *stripping*. See *Strip solution* and *Strip raffinate*.

*Notes:*

- (i) This term is ambiguous and should be used carefully. *Strip raffinate* is more appropriate.
- (ii) The term *O.K. Liquor* is not recommended.

## **Stripping**

The process of removing solute(s) from a *loaded solvent* or *extract*. Generally this refers to the main solute(s) present.

*Notes:*

- (i) Where appropriate, e.g. when liquid-liquid distribution is used for *stripping*, the term *back-extraction* can be used. The terms *back-washing* and *re-extraction* are not recommended.
- (ii) The recent application of *selective stripping* of solutes as a separation method leads to some confusion between the terms *stripping* and *scrubbing*. It is recommended that the term *scrubbing* be reserved for the operation of removing contaminants (impurities) from an *extract* (where the *scrub raffinate* is often recycled to the loading step) and the term *selective stripping* be used where two or more main solutes are stripped successively from an *extract*, usually with different *stripping agents*), with a view to their subsequent separate recovery from solution for analysis.

## **Stripping Agent**

The active substance effective in *stripping*.

## **Stripping Agent Solution**

The liquid phase used to accomplish *stripping*.

## **Stripping Ratio**

See *Distribution ratio*.

*Notes:*

- (i) This term is usually defined as the inverse ratio to the *Distribution ratio*, i.e. in aqueous-organic systems the aqueous phase concentration of solute is the numerator and the organic phase concentration the denominator. Their usage should be clearly defined.

(ii) The term *stripping coefficient* is not recommended.

### **Stripping Ratio**

See *Distribution isotherm, Equilibrium line*.

*Note:* In the graphical representation of *stripping isotherms*, the axes are often interchanged from those used to represent the phases for *extraction isotherms*. It is essential that the axes be clearly labeled.

### **Strip Product Solution**

The liquid phase resulting from *stripping* of a *solvent*. See *Stripping liquor, strip solution, strip raffinate, O.K. liquor*.

*Note:* The last four terms are not recommended.

### **Strip Raffinate**

This term is not recommended. *Raffinate* should be reserved for waste streams and the liquid phase resulting from stripping normally contains the desired product.

### **Strip Solution**

The liquid phase used for *stripping*.

*Note:* There is some ambiguity between the terms *strip liquor* and *strip solution*. Perhaps *strip product solution* would be more appropriate to the former and *stripping agent solution* for the latter. See *Stripping agent*.

### **Tenor**

A term sometimes used to denote the concentration levels of various solutes in the *feed*. It is not recommended.

### **Theoretical Stage**

That part of a continuous multi-stage contactor in which the amount of solute transferred from one phase to the other is equivalent to that which would be transferred in an actual stage at equilibrium under comparable conditions of solute concentration in each phase as determined from the *distribution isotherm* and *operating line* for the system.

*Note:* Thus from the number of theoretical stages so determined and the height of the contactor the *height equivalent to a theoretical stage* (HETS) may be calculated.

### **Washing**

See *Solvent regeneration*.

*Note:* This term is vague and is not recommended.