EKSTRAKSI

- Pelarut Non polar (petroleum ether and hexane) akan melarutkan komponen non-polar (minyak, lemak, lilin)
- Pelarut polar (methanol, ethanol , air) melarutkan komponen polar (garam alkaloid and gula).

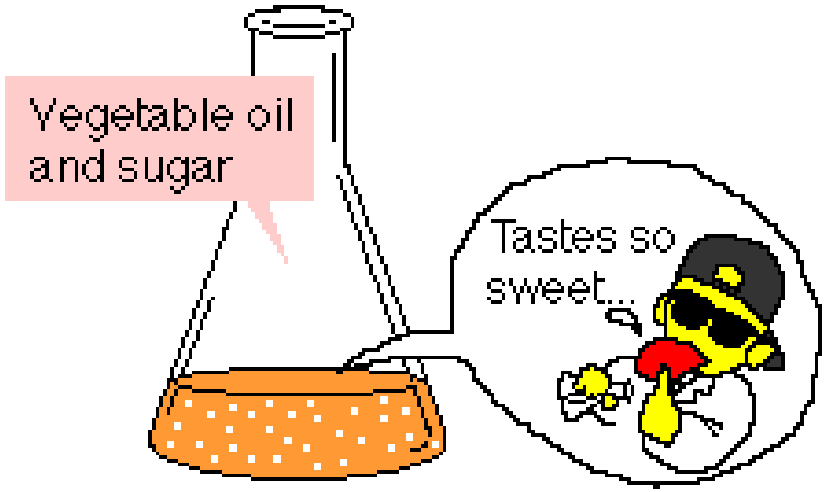
(that mean like dissolve like)

Contoh:

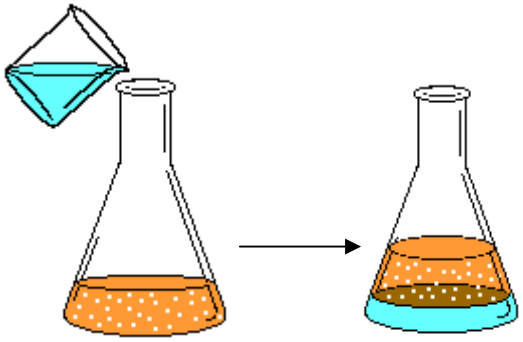
•Mula-mula ada campuran gula di dalam minyak nabati.

•Ingin dipisahkan gula dari minyak.

•Caranya???

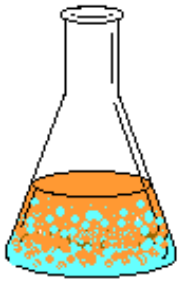


Bagaimana jika campuran tadi ditambah air?
Data: gula larut dalam air, dan
air tidak larut dalam minyak.

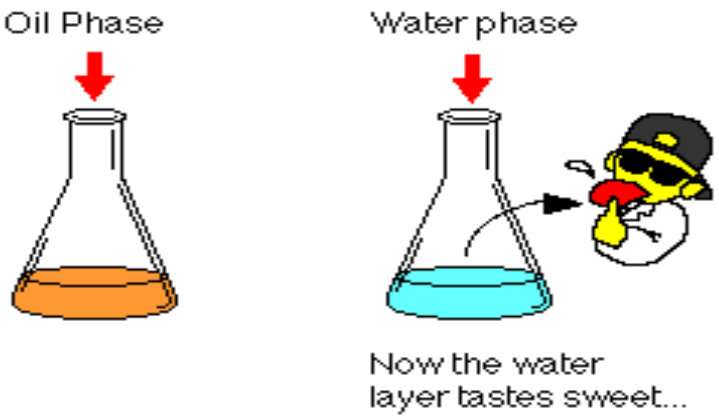


Berat jenis air >
berat jenis minyak

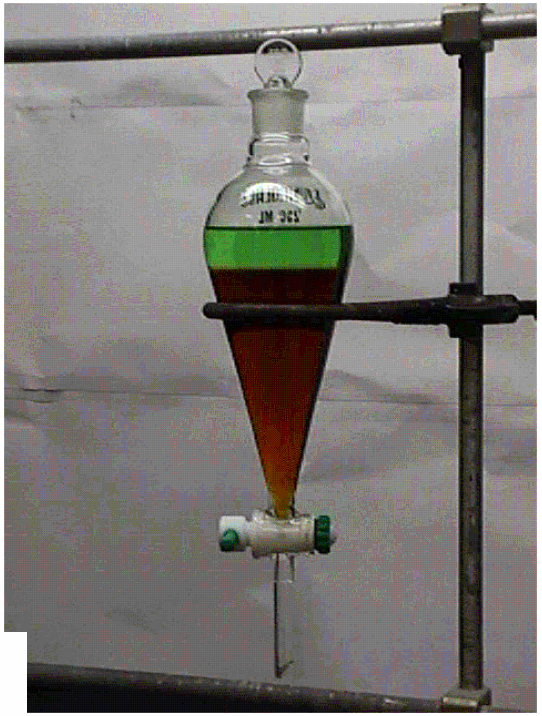
Setelah dikocok

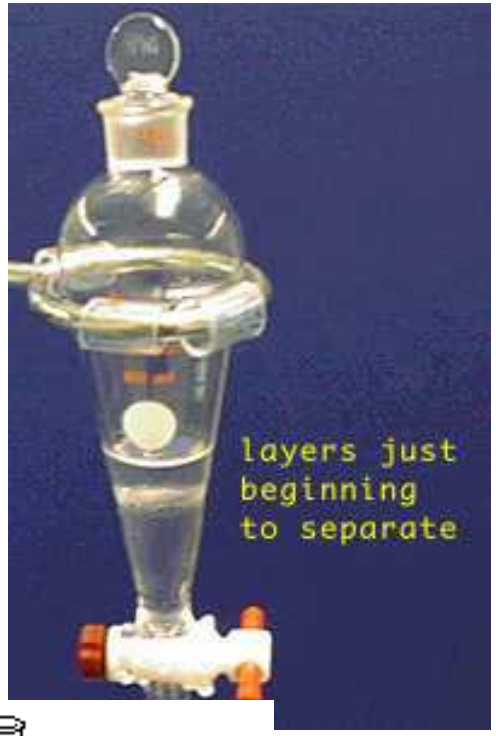


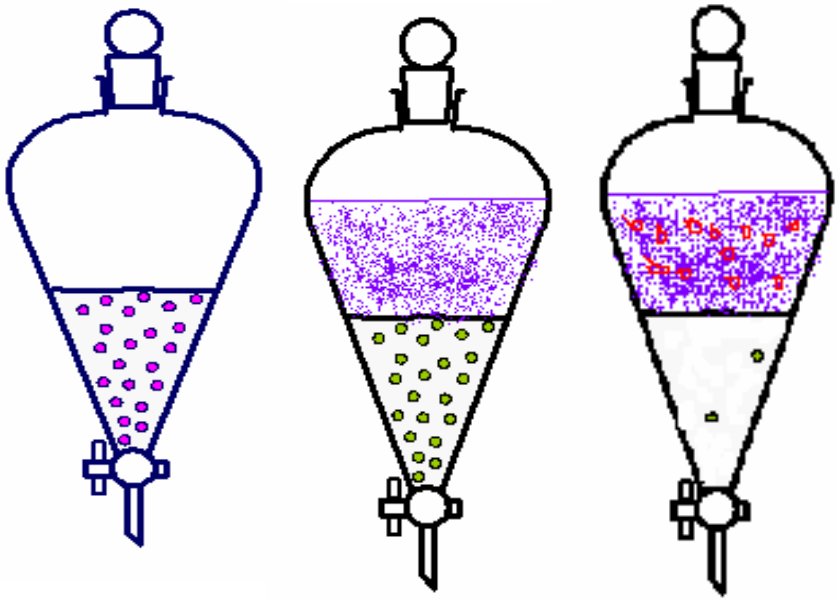
Setelah settling



EKSTRAKSI CAIR-CAIR







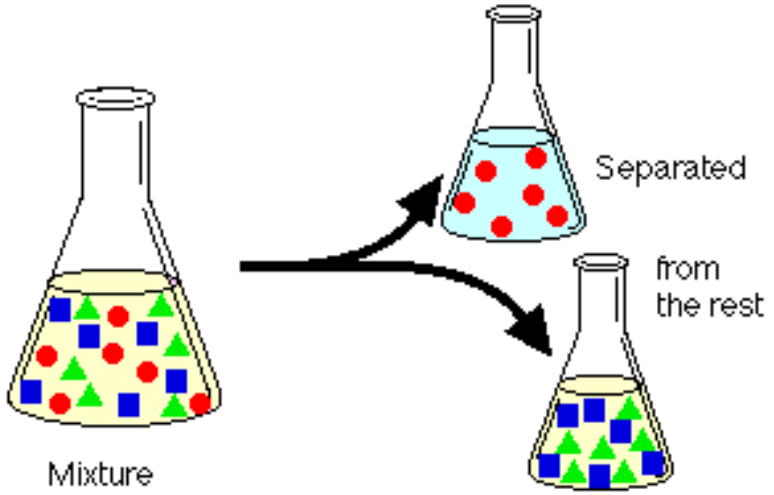
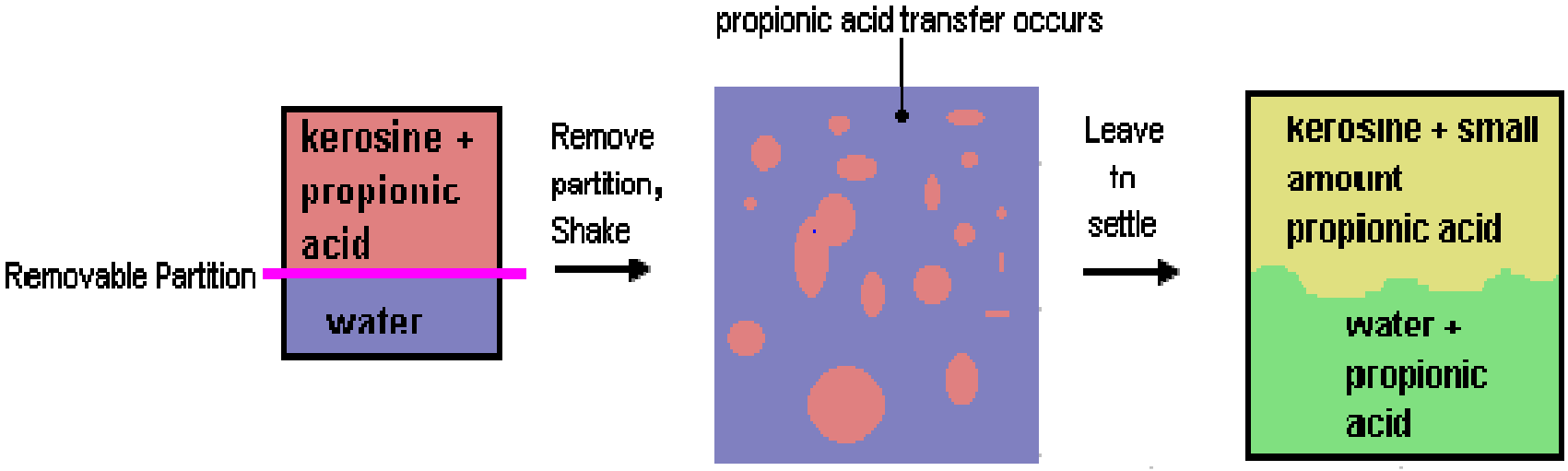


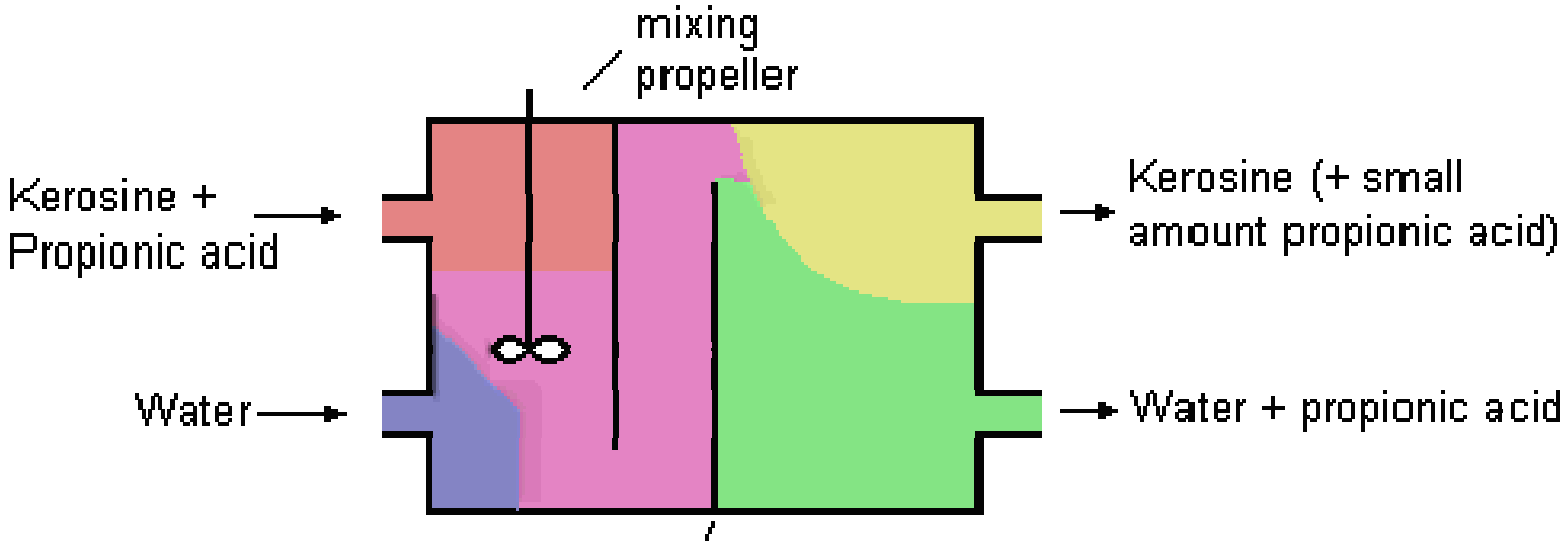
TABLE 4.1
Diffusion Coefficients and Effective Diffusion Coefficients of Food Solutes in Diverse Matrices

Food material	Solute	Solvent	Temperature (K)	D_{CB} ($\times 10^{10}$ m^2/s)
Molecular diffusion coefficients				D_{CB}
Dilute solution[a]	Sucrose	Water	298	5.4
Gelatin gel[a]	Sucrose	Water	278	0.1–0.2
Dilute solution[a]	Lactose	Water	298	4.9
Effective diffusion coefficients				D_{CBeff}
Sugar cane (across grain)[a]	Sucrose	Water	348	5.1
Sugar cane (with grain)[a]	Sucrose	Water	348	3.0
Sugar beets[a]	Sucrose	Water	297	1.6–2.5
Grape pomace[b]	Polyphenols	Water	313	0.065–0.130
			323	0.010–0.211
		Ethanol	313	0.01–0.076
			323	0.011–0.048
Coffee beans[c]	Caffeine	Water	383	3.209
Milled Berries[d]	Anthocyanins	Ethanol (67%)	313	1.23
Geranium macrorhizum L.[e]	Tannins	Water	293	1.89
Nicotiana tabacum L.[e]	Crude extract	Water	293	0.395

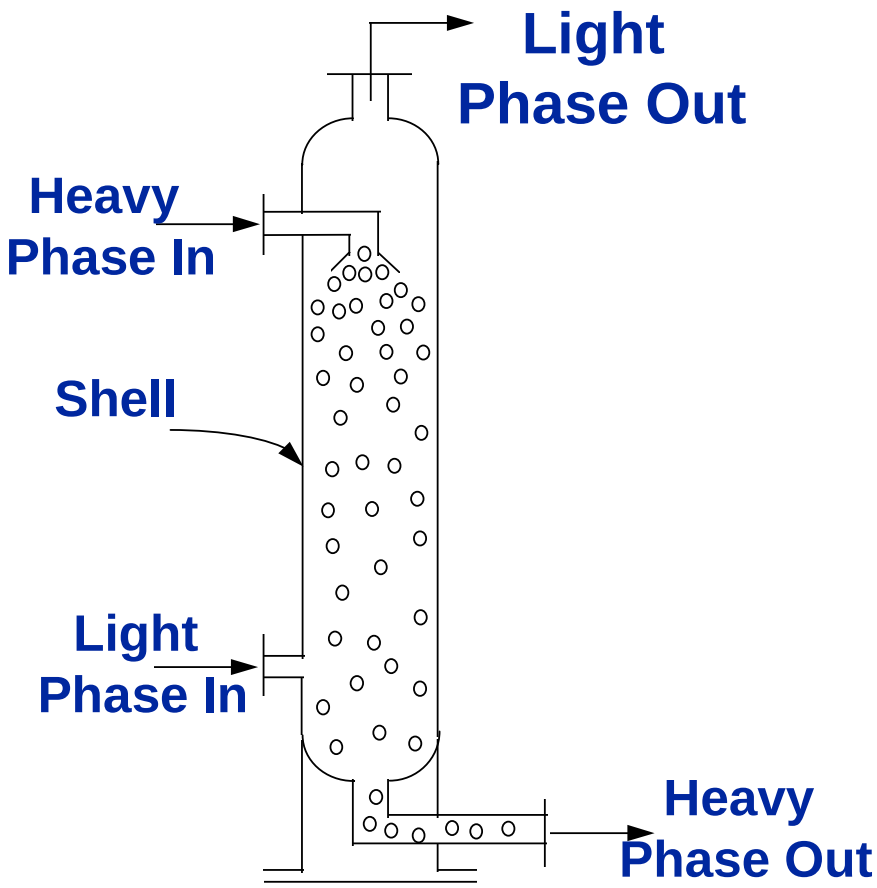
[a]Aguilera and Stanley 1999, cited by Aguilera [9]; [b]Guerrero et al. [10]; [c]Espinoza-Perez et al. [11]; [d]Cacece and Mazza [12]; [e]Simeonov et al. [51].

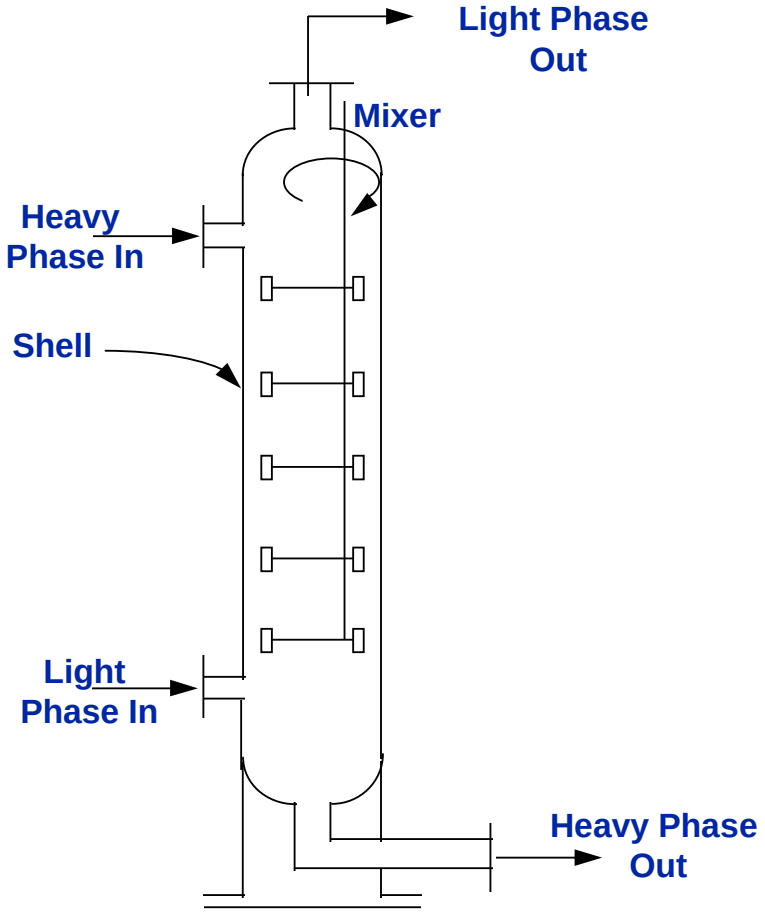
Contoh: pemisahan asam propoionat dalam kerosen menggunakan air sebagai pelarut

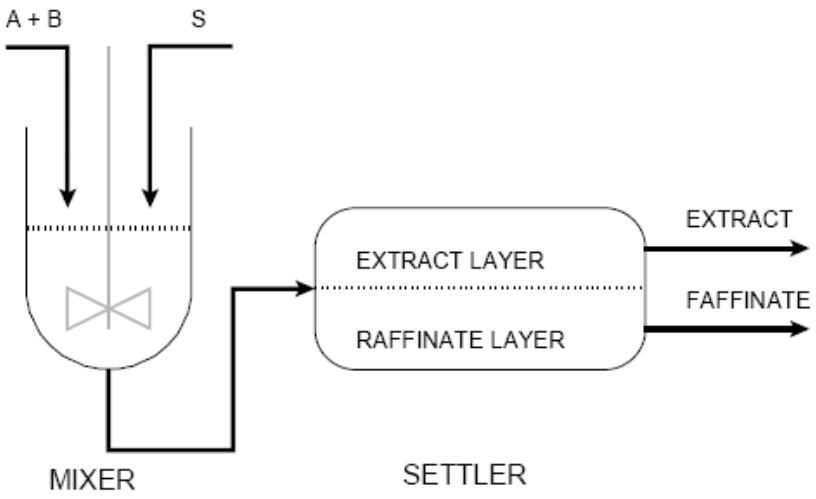


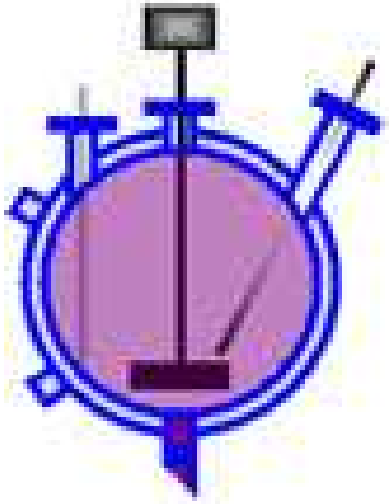


Fase-fase yang tidak saling larut, terpisah berdasarkan berat jenis.

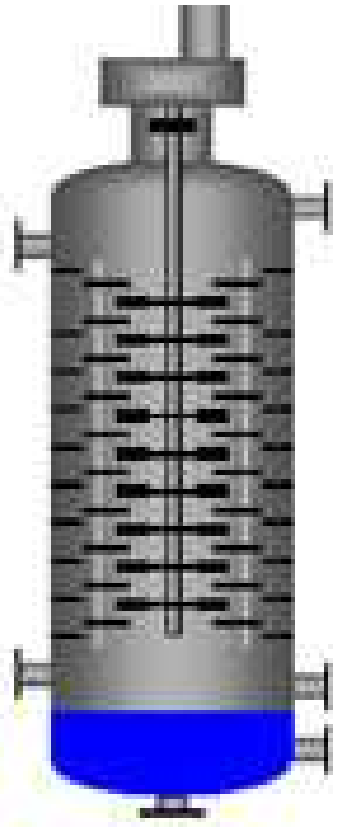




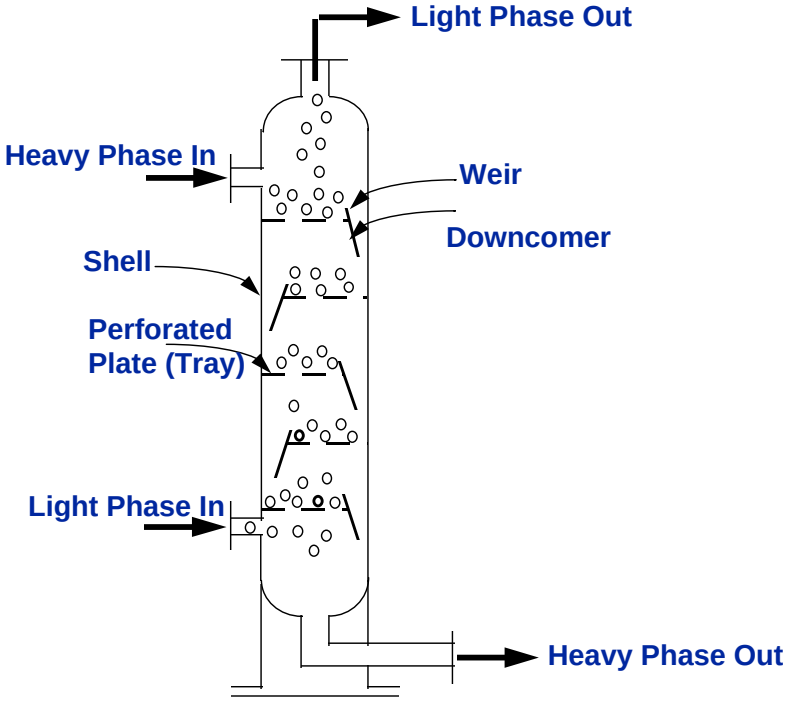


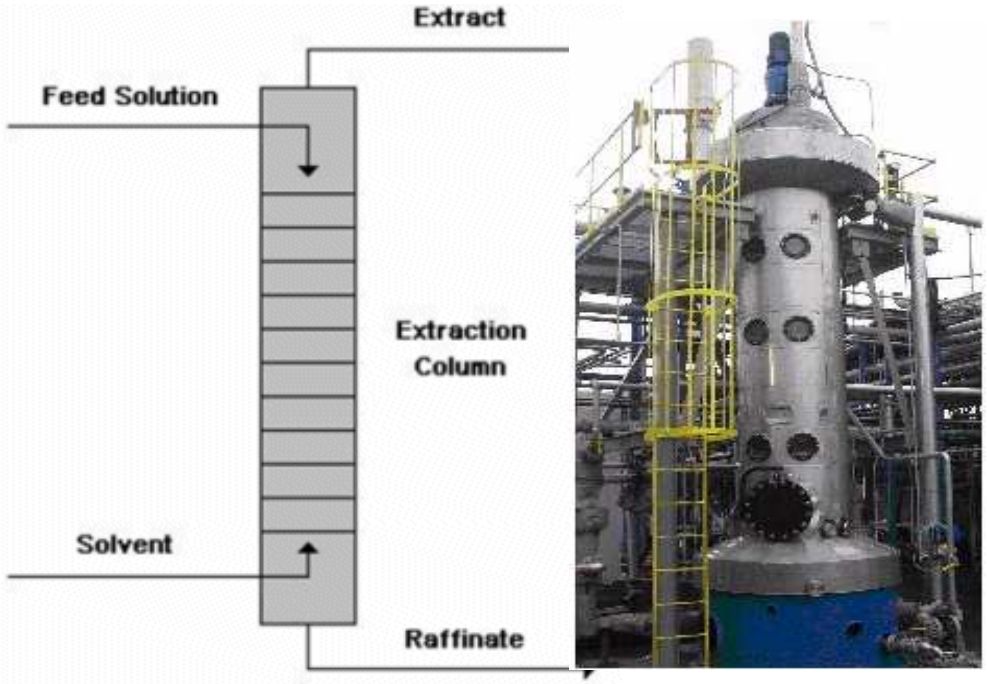


Skala lab

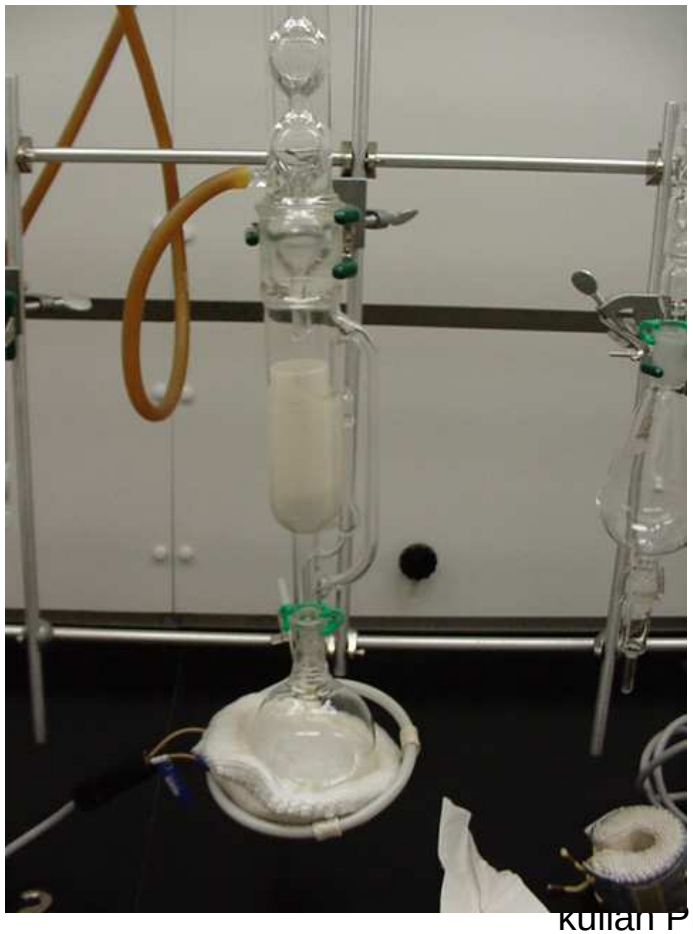


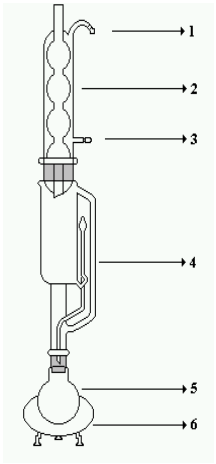
Skala industri

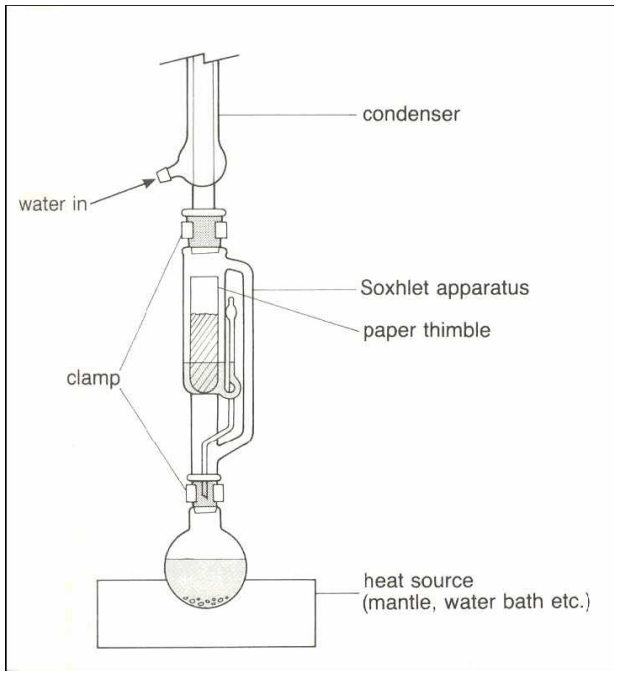

Light Phase Out
Heavy Phase In
Weir
Downcomer
Shell
Perforated
Plate (Tray)
Light Phase In
Heavy Phase Out

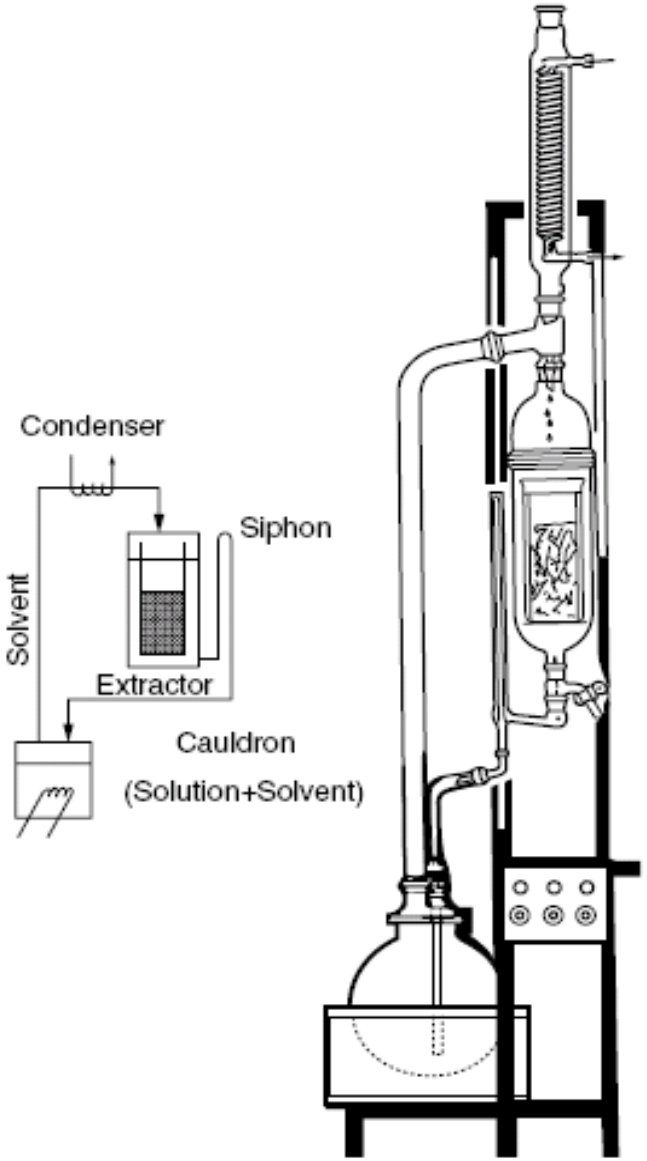

Extract
Feed Solution
Extraction
Column
Solvent
Raffinate

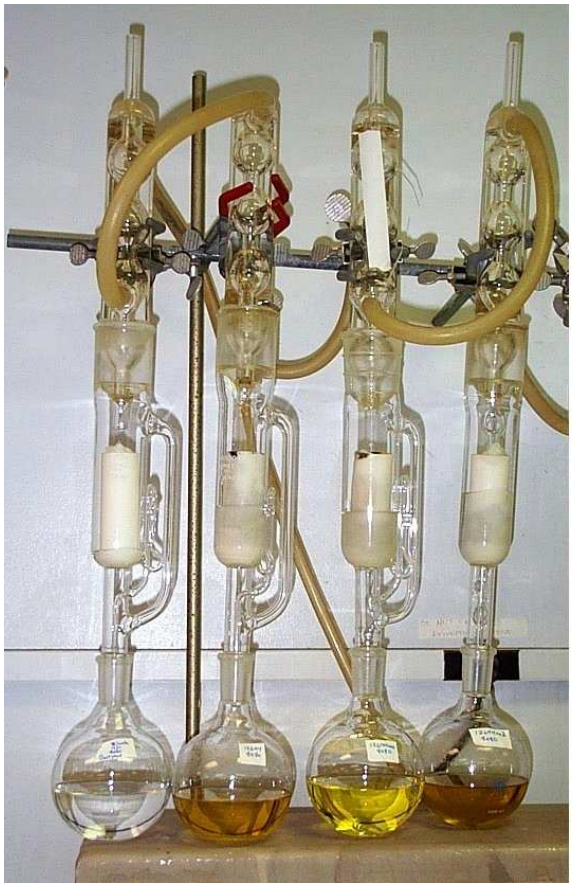
LEACHING or WASHING

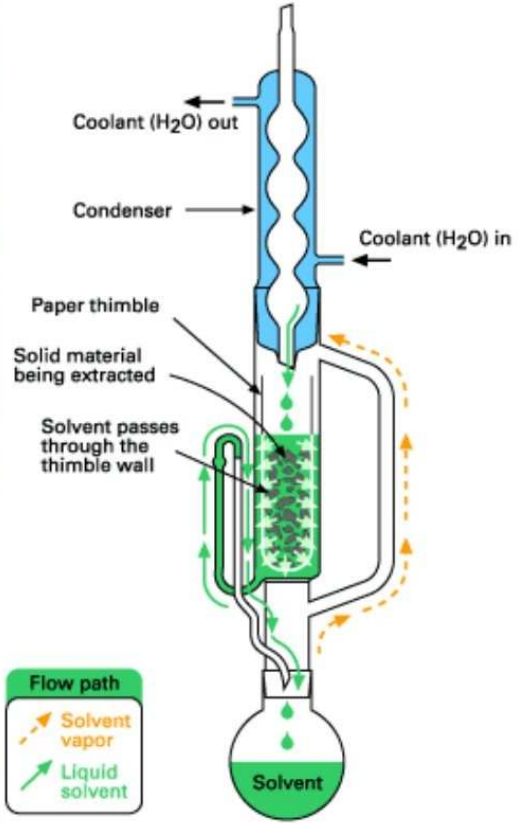


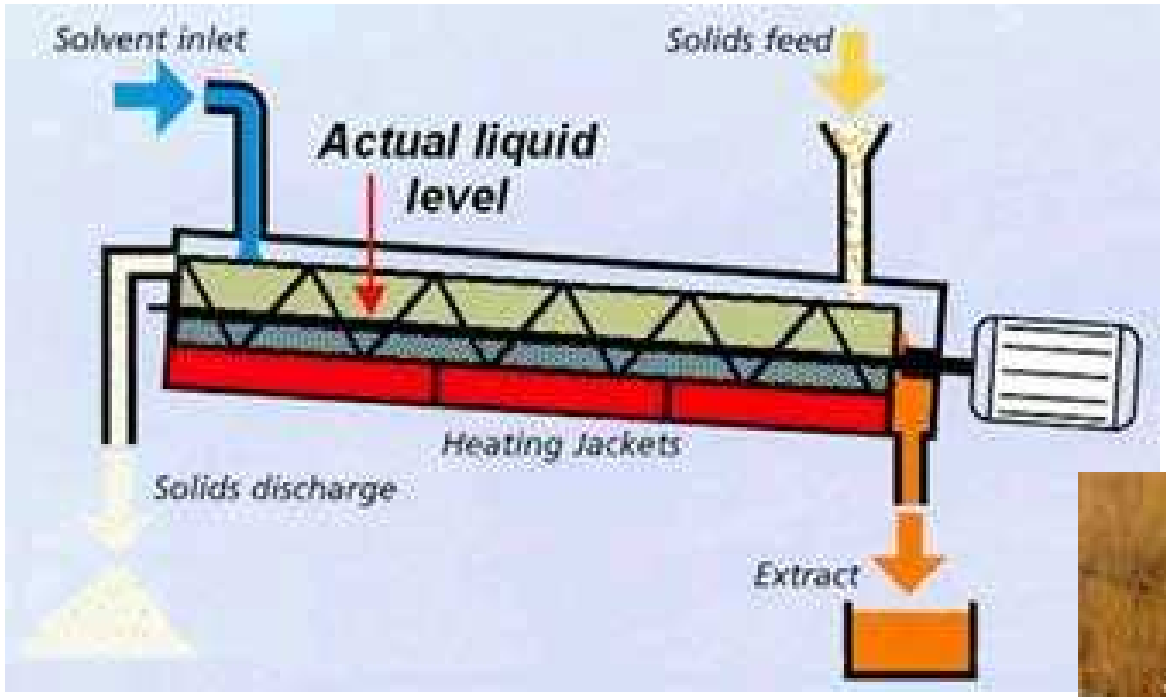




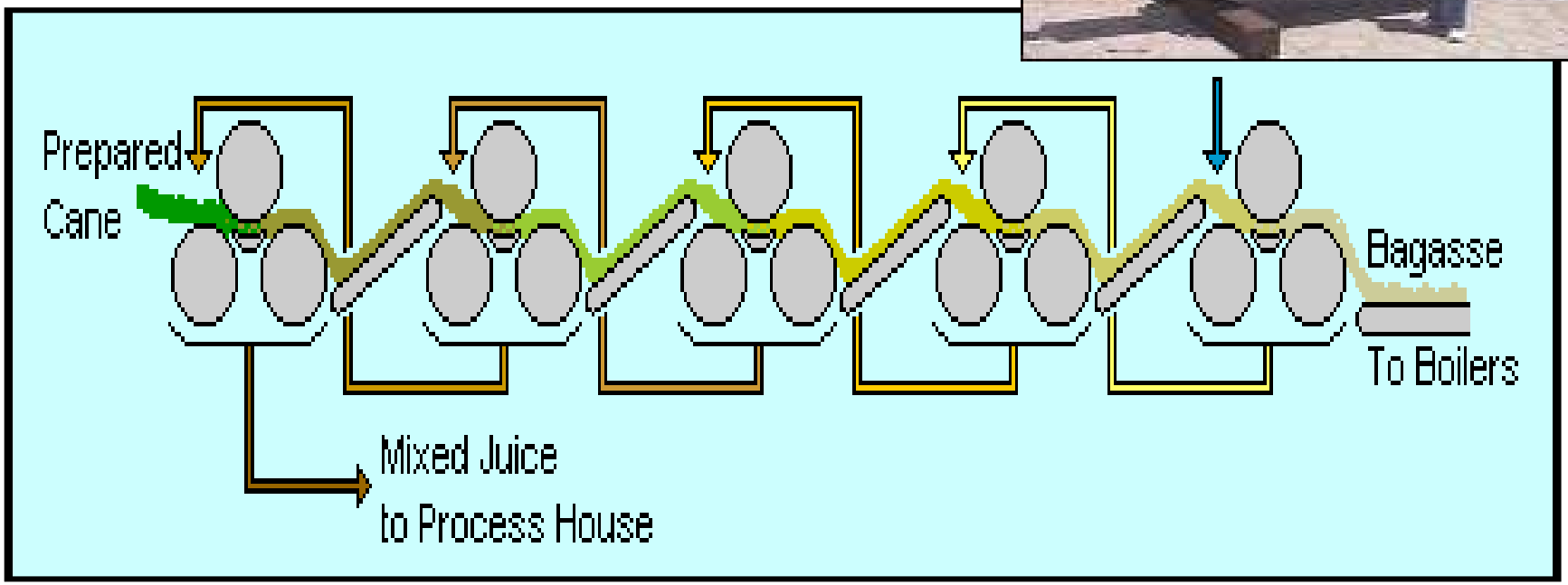

Condenser
Siphon
Solvent
Extractor
Cauldron
(Solution+Solvent)




Coolant (H_2O) out
Condenser
Coolant (H_2O) in
Paper thimble
Solid material being extracted
Solvent passes through the thimble wall
Flow path
Solvent vapor
Liquid solvent
Solvent


Solvent inlet
Solids feed
Actual liquid level
Heating Jackets
Solids discharge
Extract

Ekstraksi gula (leaching)



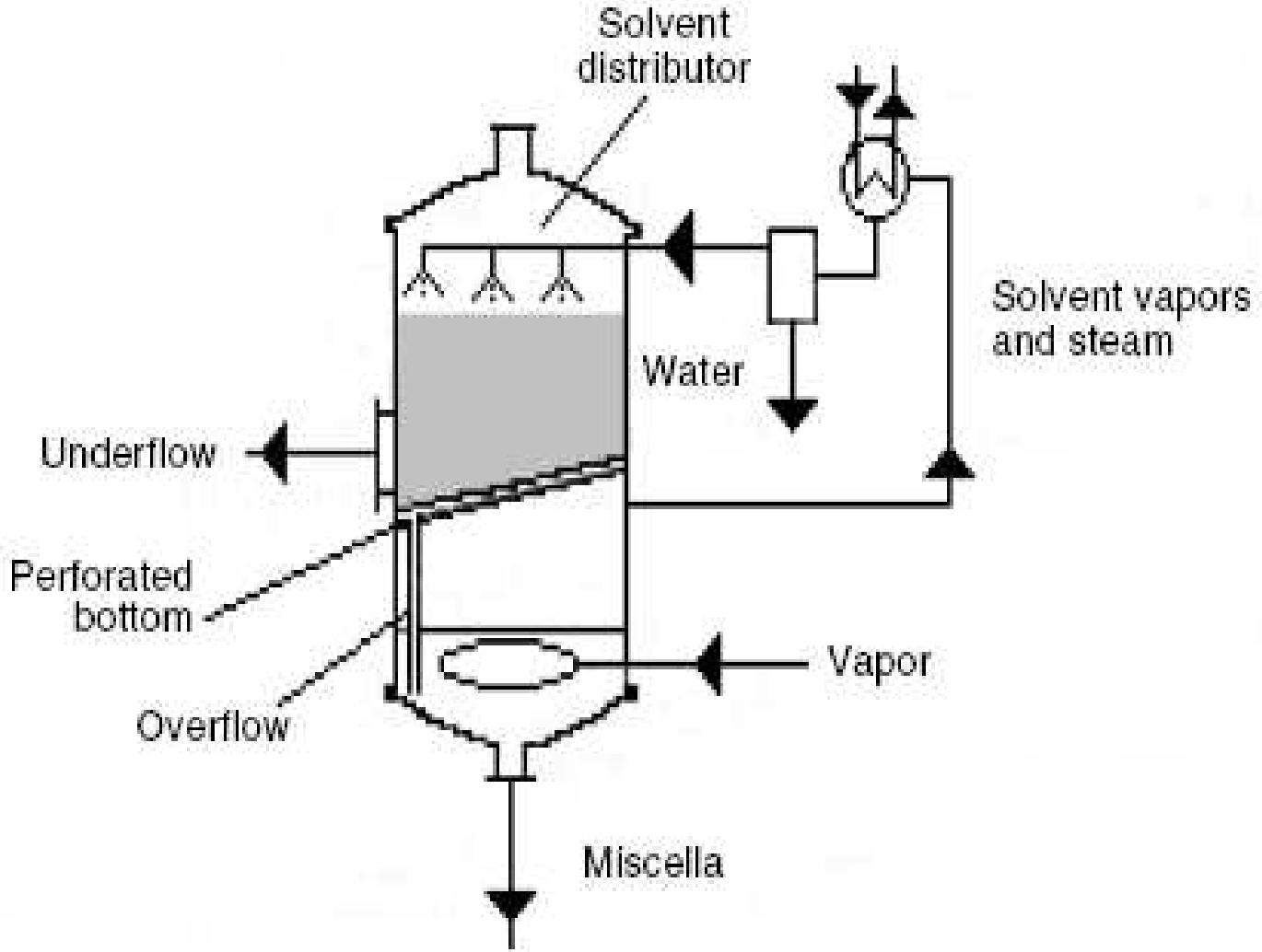


FIGURE 21.10

Batch percolator. (Adapted from Coulson, J.M. and Richardson, J.F., *Ingeniería Química*, Vols. I and VI, Reverté, Barcelona, 1979.)

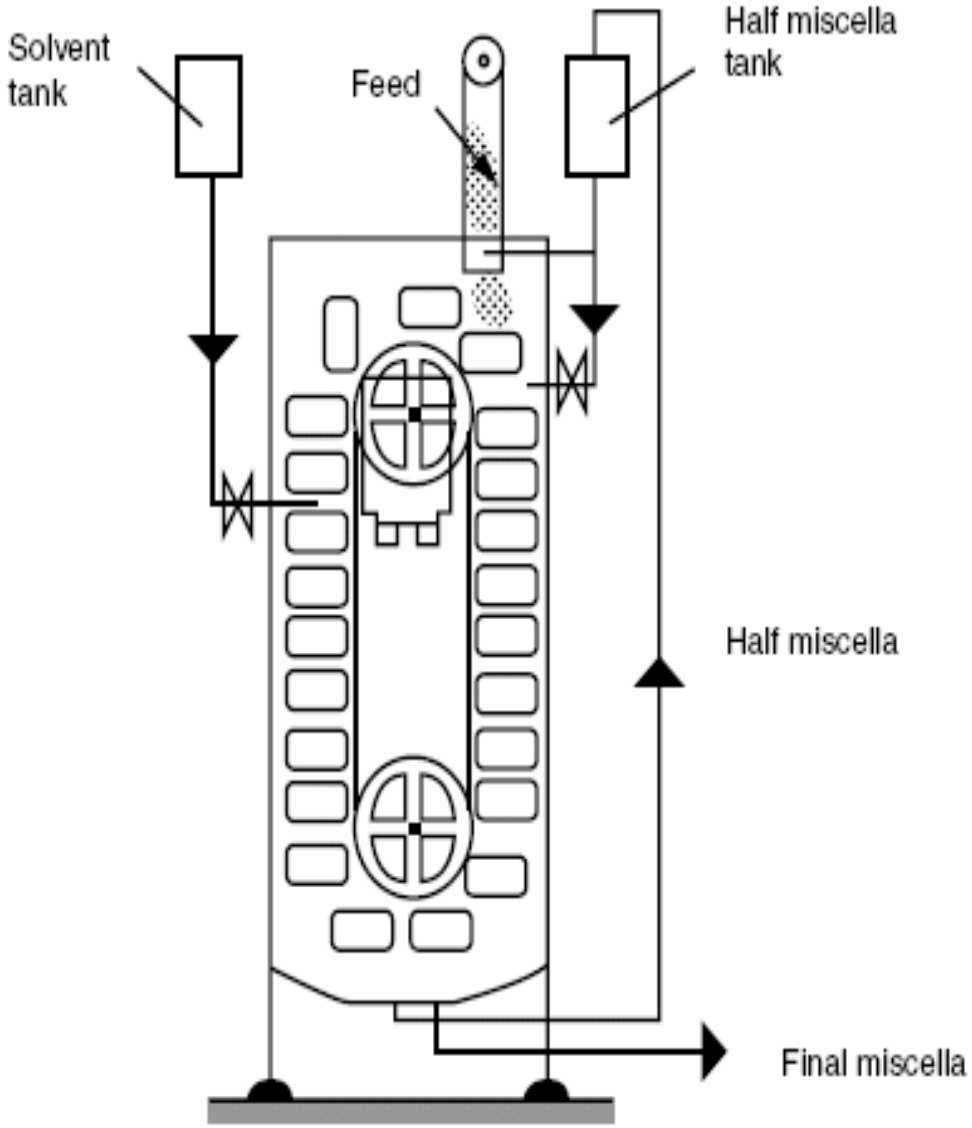


FIGURE 21.11
Bollman extractor. (Adapted from Vian, A. and Ocón, J., *Elementos de Ingeniería Química*, Aguilar, Madrid, 1967.)

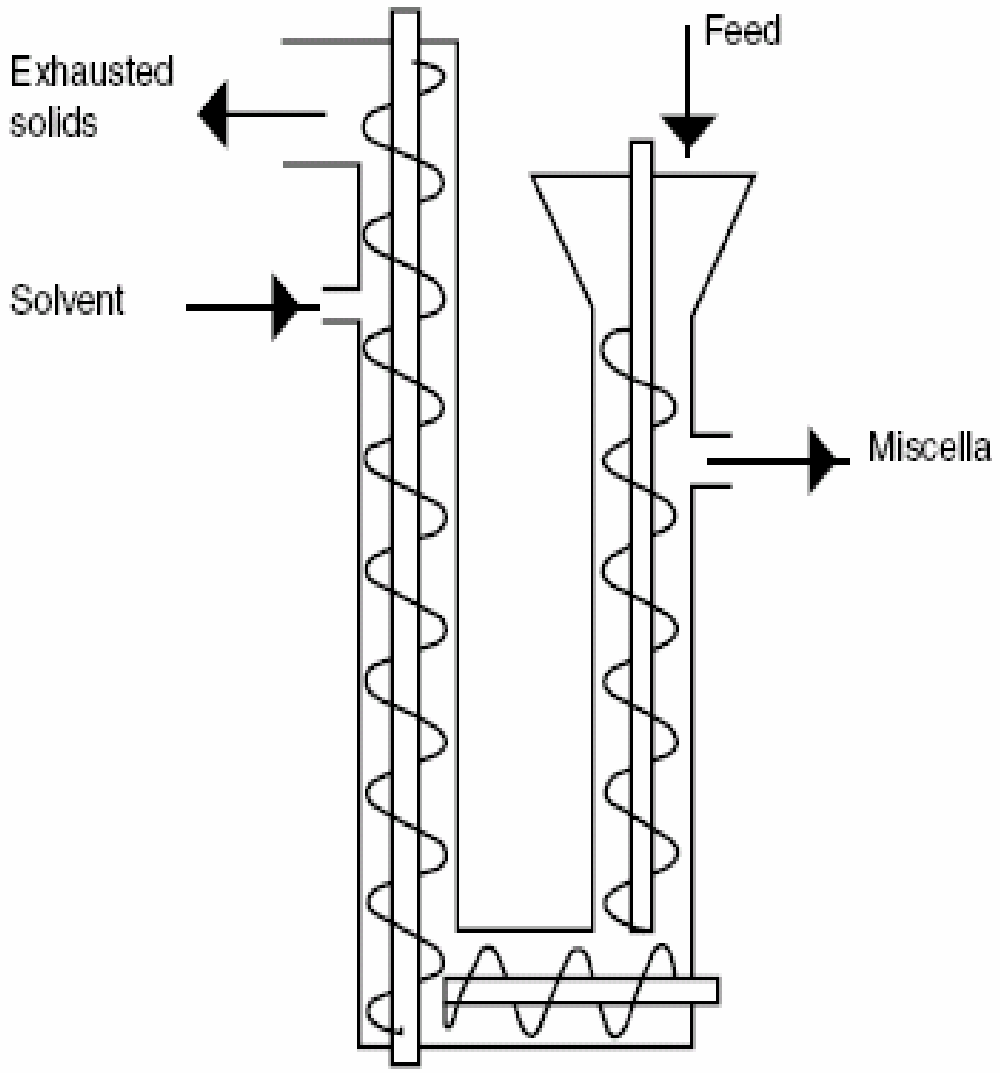


FIGURE 21.12
Hildebrandt extractor. (Adapted from McCabe, W.L., Smith, J.D., and Harriott, P., *Operaciones Unitarias en Ingeniería Química*, McGraw–Hill/Interamericana de España, Madrid, 1991.)

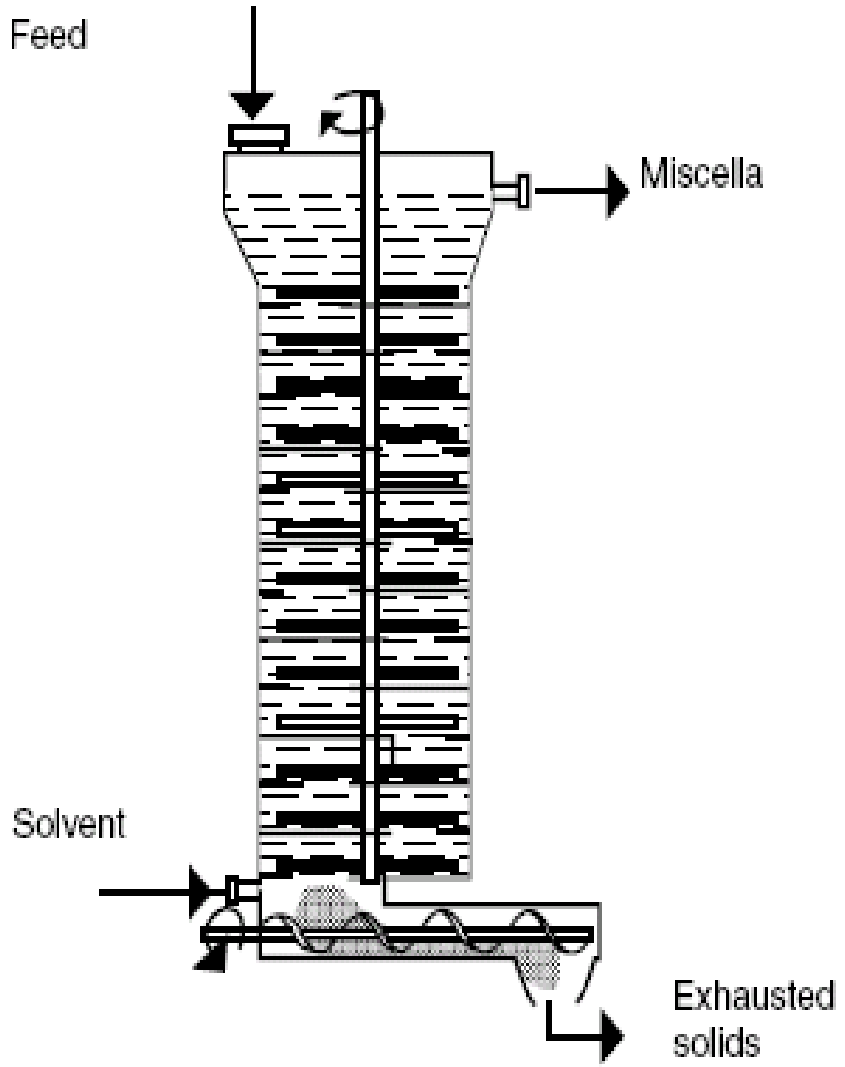


FIGURE 21.13
Bonotto extractor. (Adapted from Brennan, J.G. et al., *Los Operaciones de la Ingeniería de los Alimentos*, Acribia, Zaragoza, Spain, 1980.)

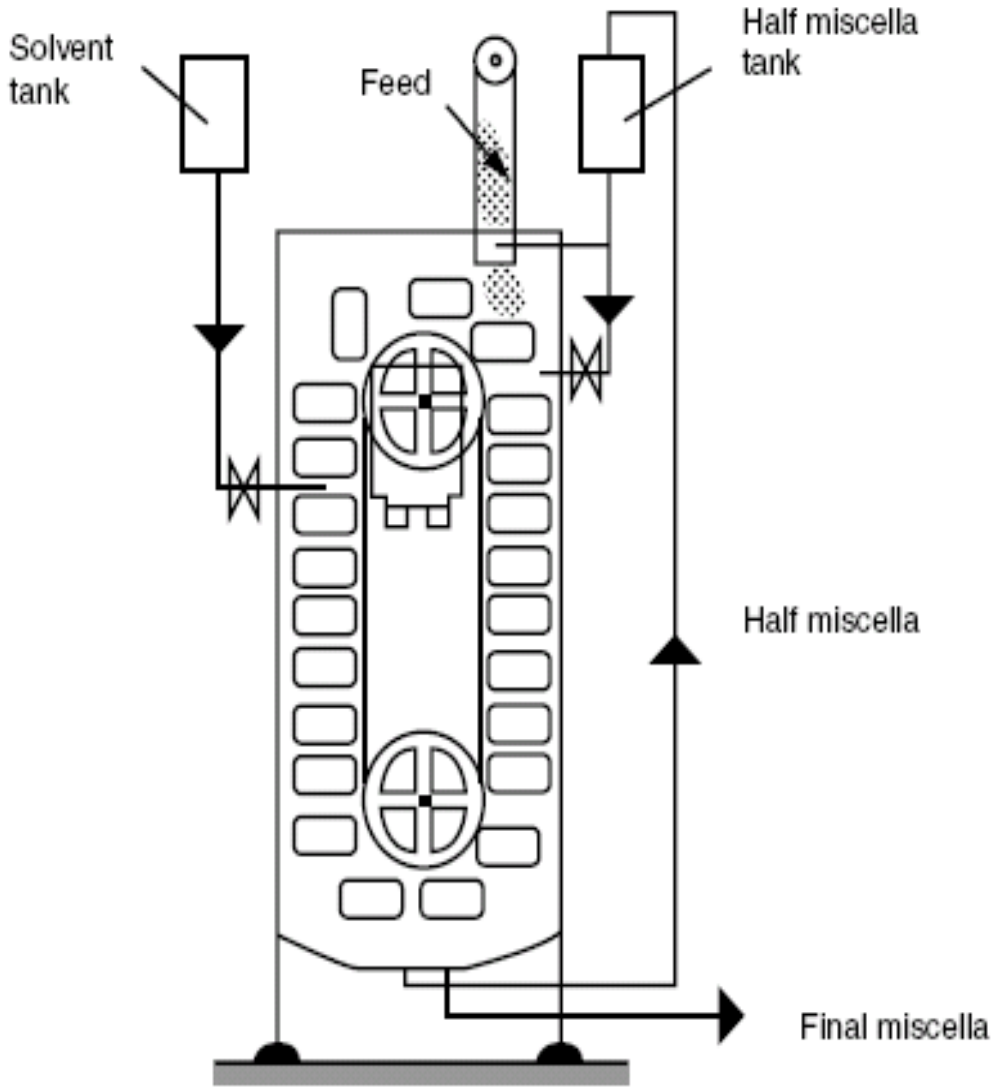


FIGURE 21.14
Rotocel extractor. (Adapted from Vian, A. and Ocón, J., *Elementos de Ingeniería Química*, Aguilar, Madrid, 1967.)

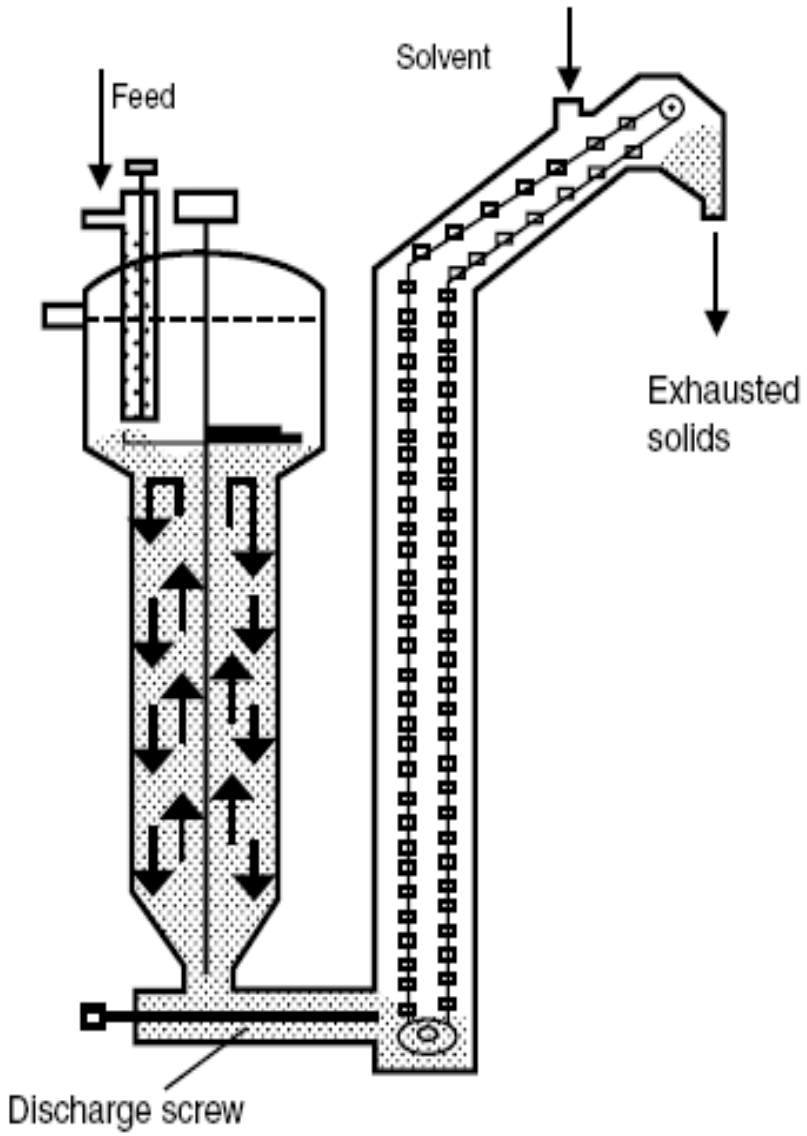


FIGURE 21.15
Vertical immersion column extractor. (Adapted from Bernardini, E., *Technologia de Aceites y Grasas*, Alhambra, Madrid, 1981.)

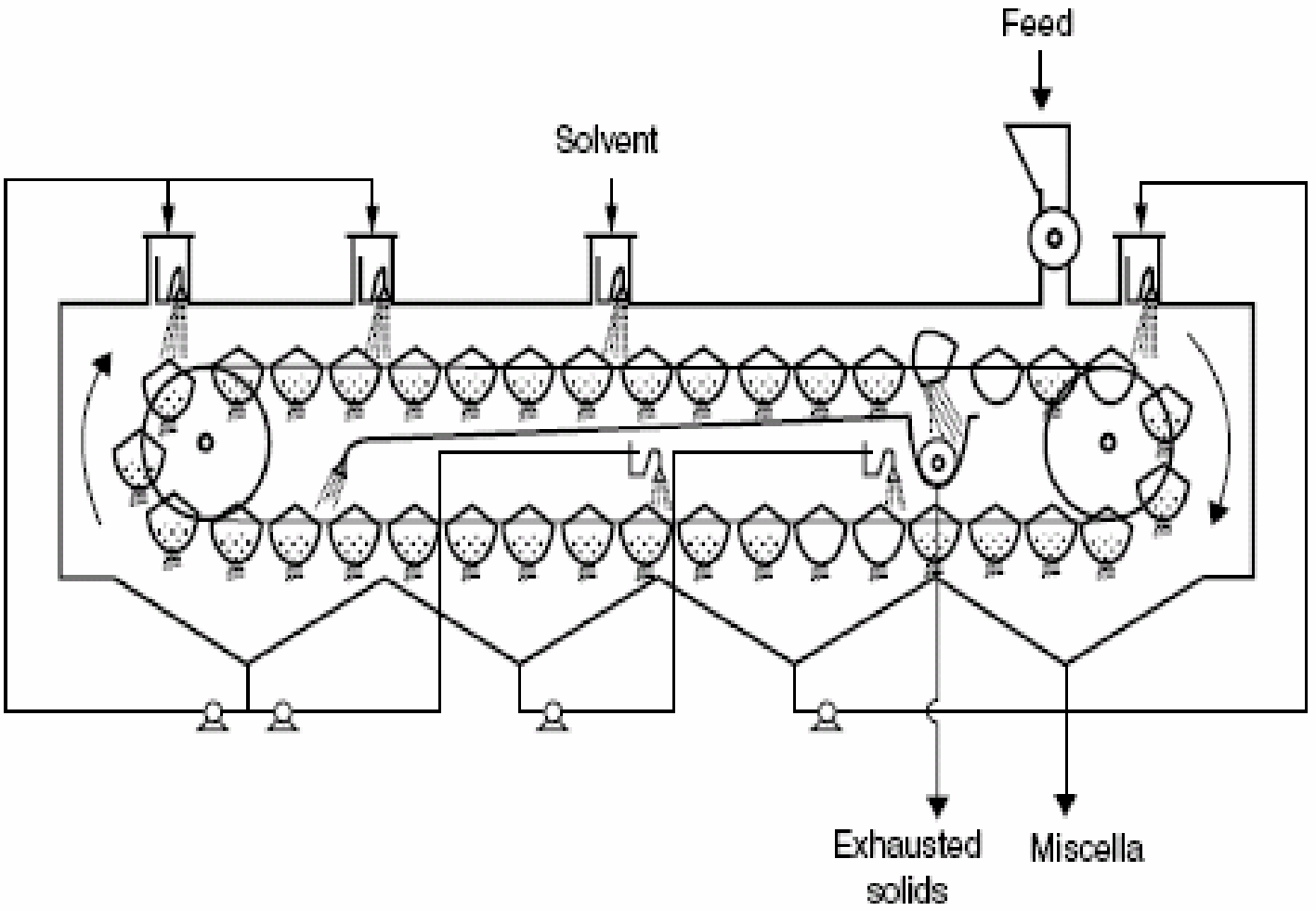


FIGURE 21.16
Percolation extractor. (Adapted from Bernardini, E., *Technología de Aceites y Grasas*, Alhambra, Madrid, 1981.)

TABLE 4.2
Characteristics and Applications of Solvent Extraction Systems

Operation	Working principle	Extraction system	Field application	Examples
Batch	Immersion extraction	Stirred vessel	Pharmacy	Alkaloids
	Static bed percolation	Single-stage percolator	Spices	Pepper
	Static bed crosscurrent percolation	Multistage percolator		
Quasi-continuous	Stationary bed, countercurrent percolation	Multistage percolator battery	Instant material, sugar	Instant coffee, sugar from beets
Continuous	Rotating cell, countercurrent percolation	Rotocel	Sugar, vegetable oil	Soybean oil
	Rotating bed, countercurrent percolation, stationary sieve tray bottom	Carrousel	Vegetable oil, spices, instant material	Soybean oil, paprika, pepper, hop
	Stationary bed, countercurrent percolation, rotating feed/ discharging locations	Stationary basket	Vegetable oil, spices	Wheat germ, paprika
	Horizontal moving bed, countercurrent percolation	Sieve tray belt; sliding cell	Sugar	Sugar from beets/cane
	Horizontal moving bed, co-/countercurrent percolation	Crown loop extractor	Vegetable oil, sugar	Sugar cane/ soybean oil
	Vertical moving bed, co-/ countercurrent percolation	Basket elevator	Vegetable oil	Flaked oil seeds
	Moving bed, countercurrent immersion	Screw conveyer	Sugar, vegetable oil	Sugar beets, soybean oil

Bioactive compound	Source	Adsorbent
Cyanidin-3-glucoside	Aqueous solutions	Several resins
Deodorized garlic extract	Garlic	Several resins
EPA and DHA	Fish oil	Modified zeolite 13X
Flavonoid compounds	Leaf extract of *Ginkgo biloba*	Polycarboxyl ester resin XAD7
Flavonoid glycosides and terpene lactones	Leaf extract of *Ginkgo biloba*	Amberlite XAD-7HP
Flavonoid compounds	Leaf extract of *Ginkgo biloba*	Macroporous copolymer MA-DVB beads
Flavonol glycosides and terpene lactones	Leaf extract of *Ginkgo biloba*	Macroporous polymethacrylate beads
Hesperidin	Aqueous solutions	Styrene-divinylbenzene and acrylic resins
Hesperidin	Orange peel waste	Styrene-divinylbenzene resin
Hesperidin	Orange juice processing wastewater	Styrene-divinylbenzene resin

Odorless garlic	Garlic	Cyclodextrin
Oleuropein and rutin antioxidants	Olive leaf	Silk fibroin
Phenolic compounds	Distilled grape pomace	Different shape activated carbons
Phenolic compounds	Inga edulis leaves	Several resins
Phenolic compounds	Apple juice	Polumethilmetracrylate resin
Tea polyphenol	Green tea leaves	Several resins
Vitamin B12 and cephalosporin-C	Fermentation products	Nonionic polymeric adsorbents (commercial)
Vitamin E (α-tocopherol)	Palm fatty acid distillate	Silica
Vitamin E (α-tocopherol)	Palm fatty acid distillate	Silica gel, aluminum oxide, synthetic brominated polyaromatic SP 207, and functionalized
Vitamin E (α-tocopherol)	Solutions with different polar and nonpolar solvents	Mesoporous carbons CMK-1, CMK-3
Vitexin and isovitexin	Pigeonpea extracts	Macroporous resins