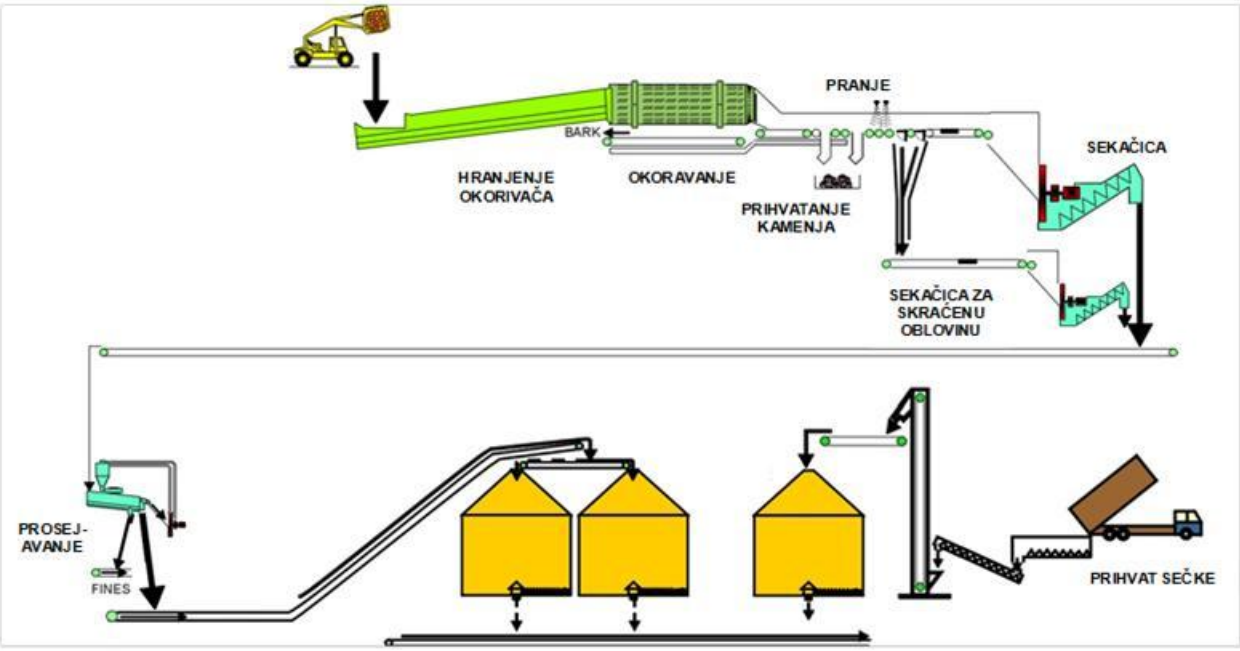
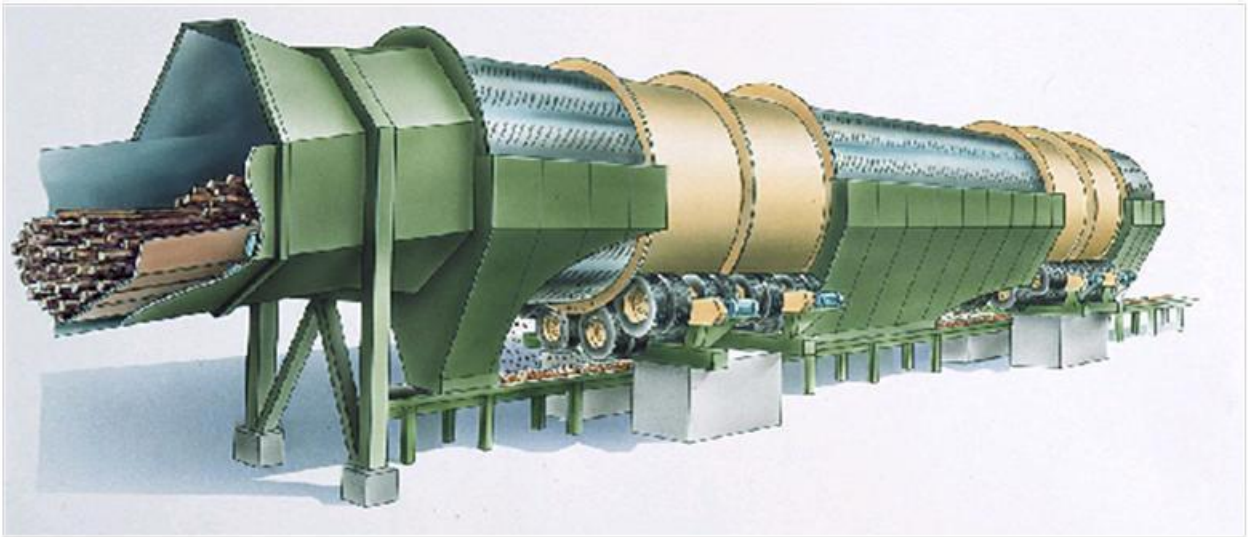
Izrada vlakana (Pulpovanje)

Vrsta vlakana / postupak		**Vrsta energije**	**Vrsta sirovine**	**Prinos**
Drvenjača (oblice)				
Mehanički postupci	bela	Mehanička Toplotna	Drvo svelte boje: Smrča, jela, topola	93-99%
	mrka			80-90%
Nove tehnologije proizvodnje drvenjače ➢ drvenjače pod pritiskom, PGW ➢ drvenjače pod super pritiskom PGW-S				
Vlakna visokog prinosa (sečka)				
Mehanički postupci	RMP (slično beloj)	Mehanička Toplotna		94-96%
	TMP (slično mrkoj)			
Mešoviti (kombinovani) postupci	CMP (hemijsko-mehaničko pulpovanje)	Mehanička i hemijska uz prethodni tretman hemikalijama (1-5%)	lišćari	<85 %.
	CTMP (termo-hemijsko-mehaničko pulpovanje)		Smrča, bor, eukaliptus, jasika, breza, topola	85 %.
Semihemijsko pulpovanje – proizvodnja poluceluloze (drvo lošijeg kvaliteta, može i neokorano)				
Kombinovani postupci	**NSSC postupak (neutralno-sulfitni)**	Hemijske (Na_2CO_3 i $NaHCO_3$) i mehaničke	Mešavina lišćara	75 – 80 %
	CCSC postupak (hladni natronski)		Lišćari	88 – 94 %
Hemijsko pulpovanje – proizvodnja tehničke celuloze (drvo lošijeg kvaliteta, može i neokorano)				
Hemijski postupci	**sulfatni**	Hemijskea	Lišćari, četinari	45-60 %
	sulfitni		Lišćari	45-55 %

Priprema drvne sirovine za proizvodnju vlaknastih polufabrikata

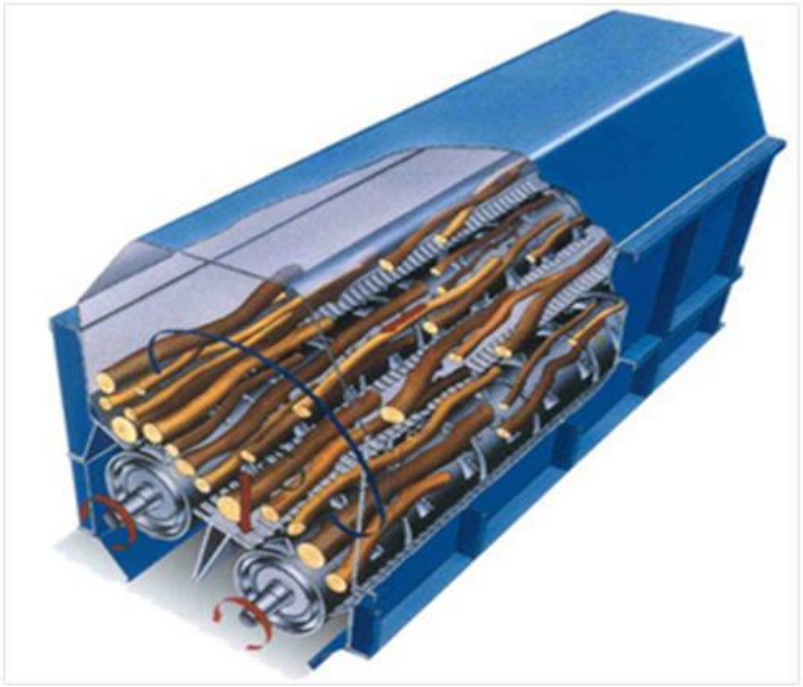


Okoravanje



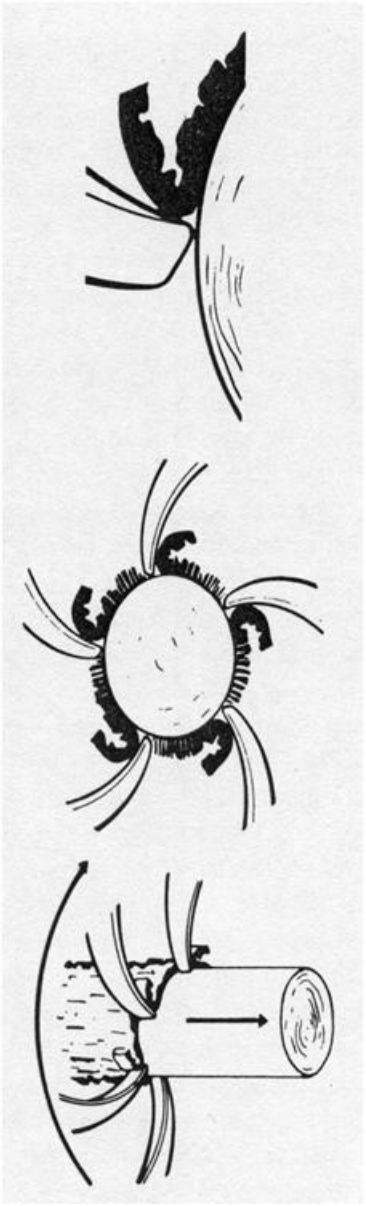
Bubanj okorivač

mokro okoravanje



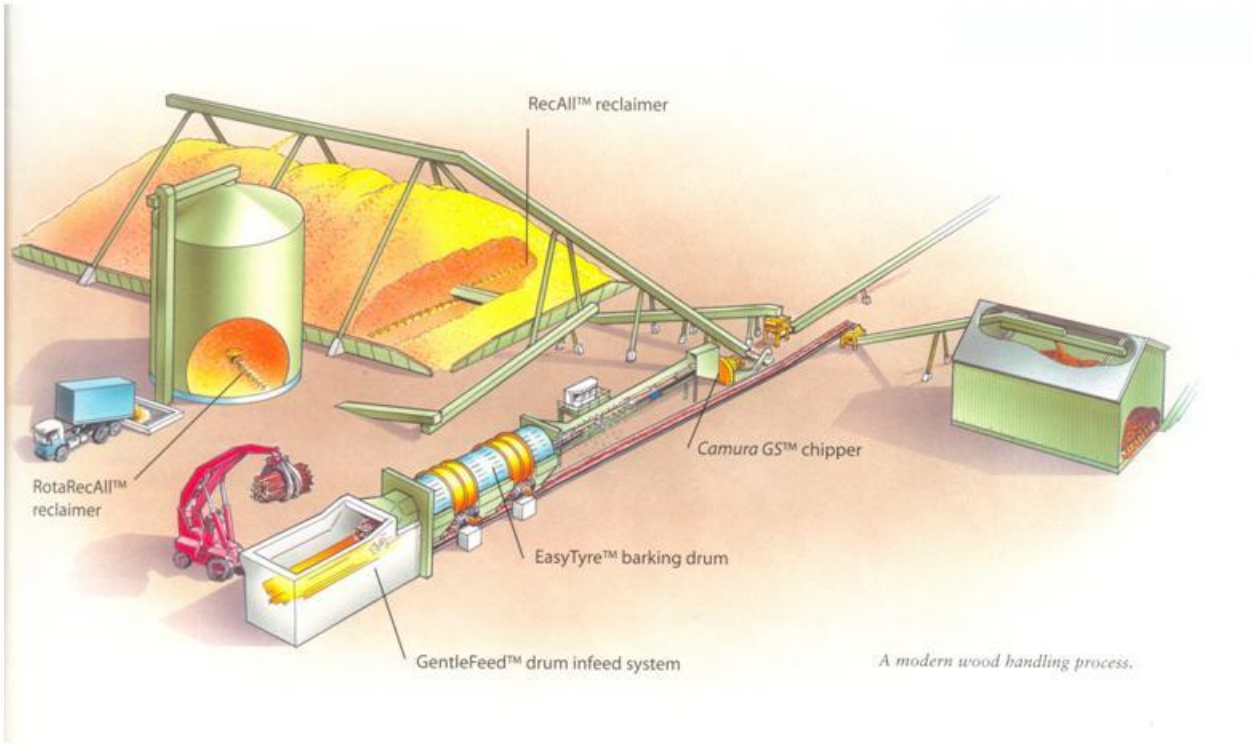
suvo okoravanje

Mehaničko-frikcioni okorivači

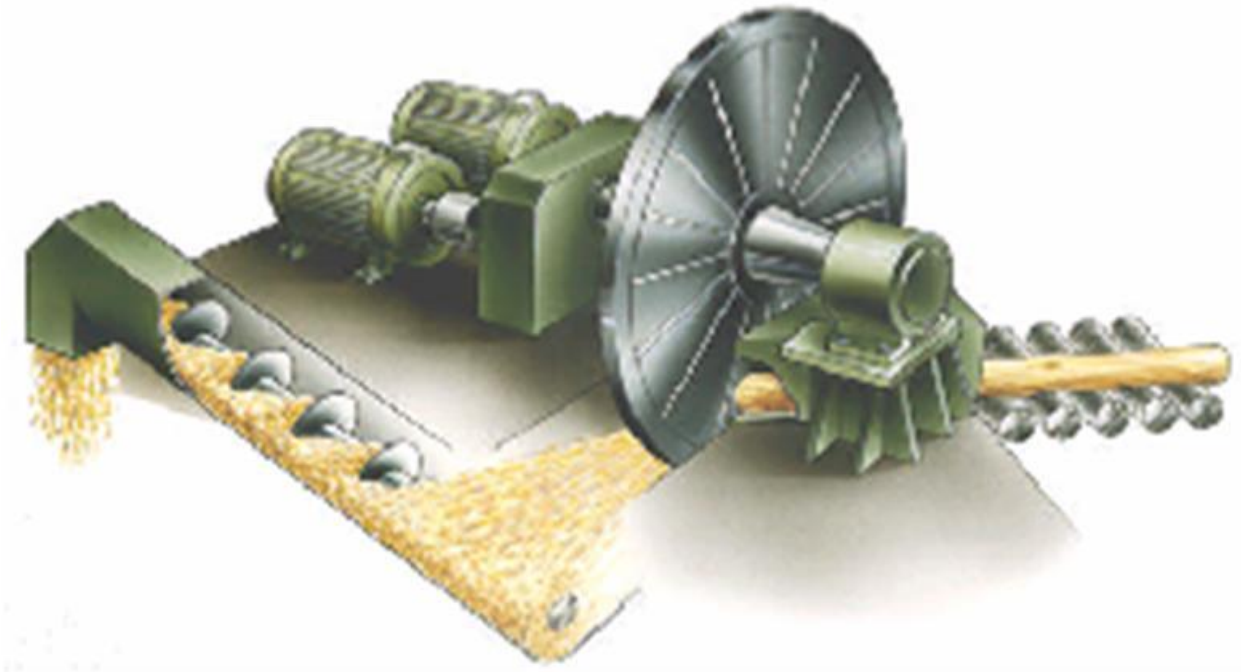


Okorivači sa noževima

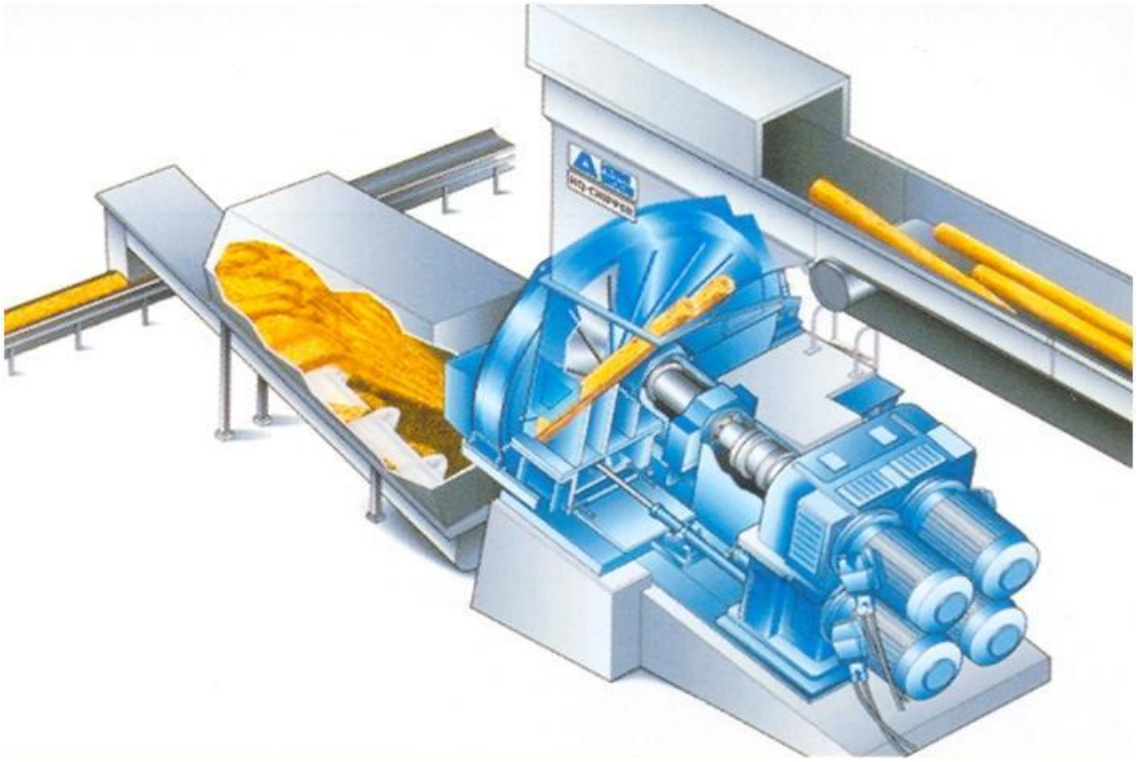
IZRADA SEČKE



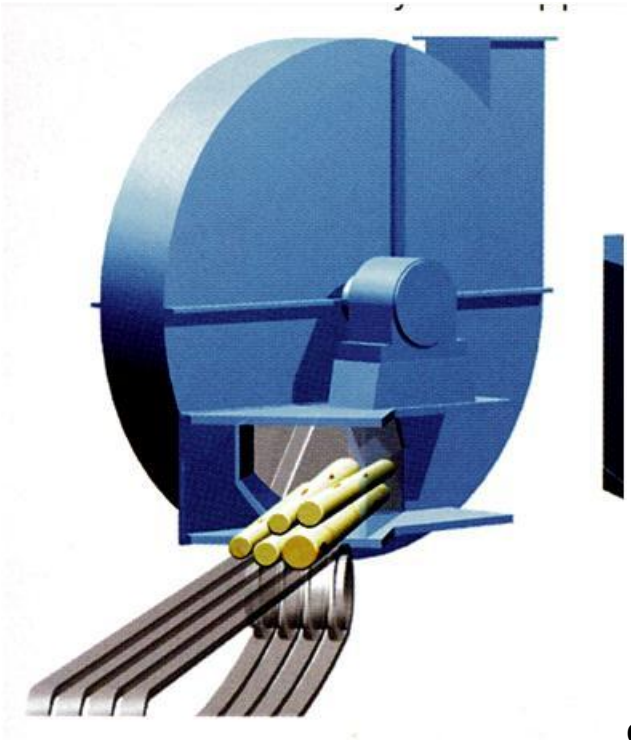
A modern wood handling process.



disk sekačica

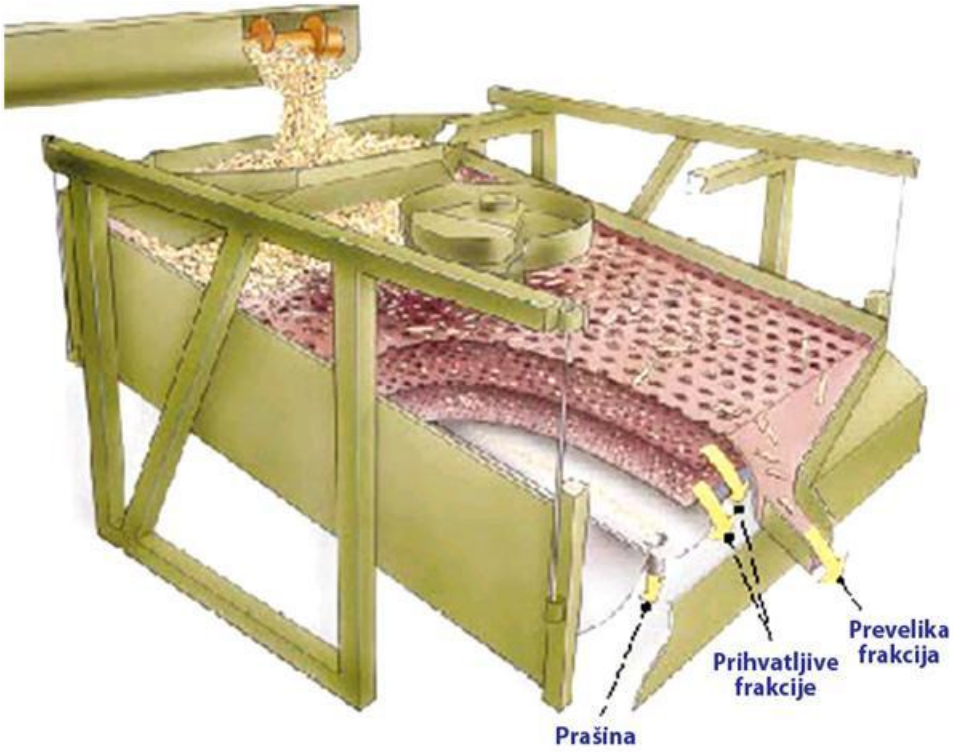


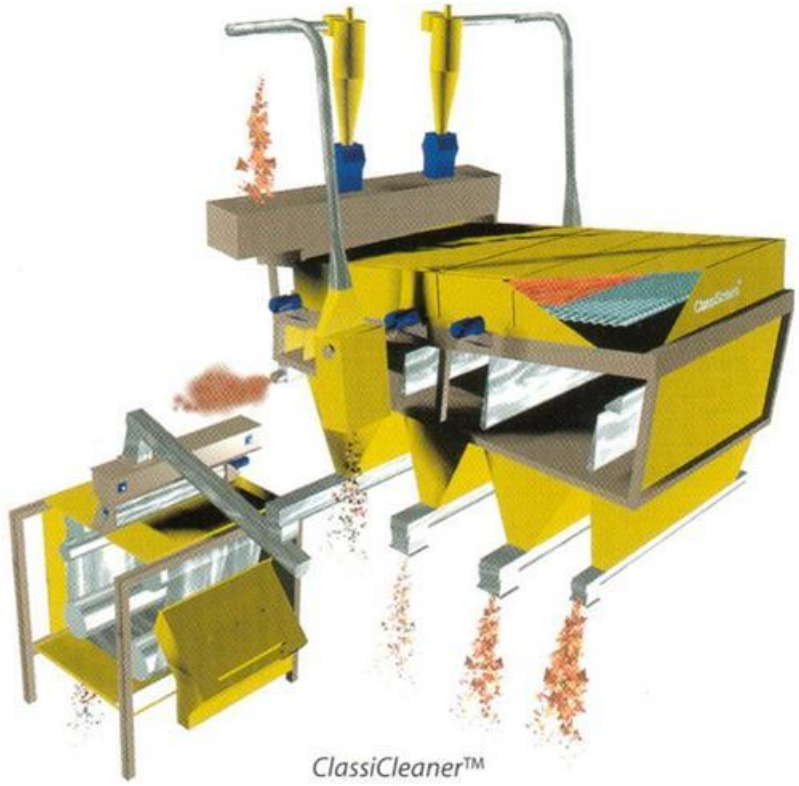
disk sekačica



disk sekačica

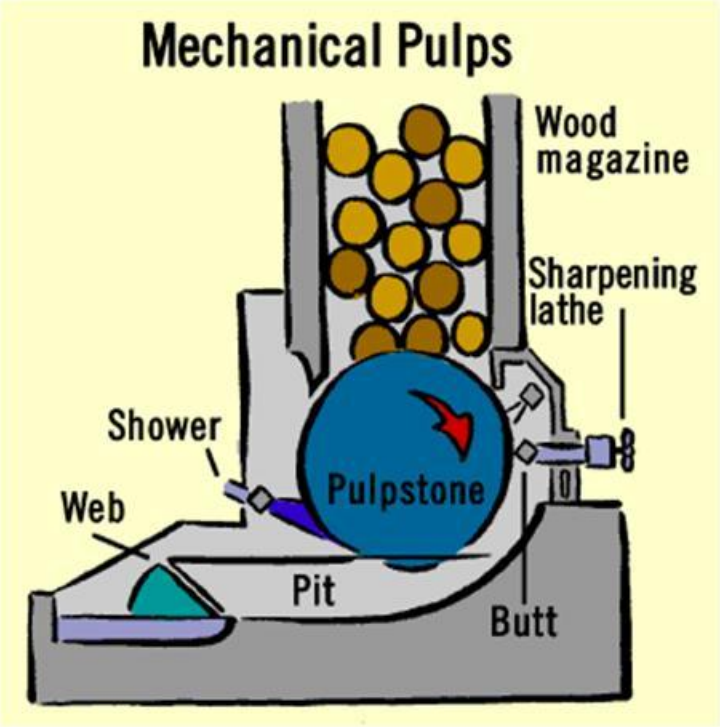
PROSEJAVANJE SEČKE

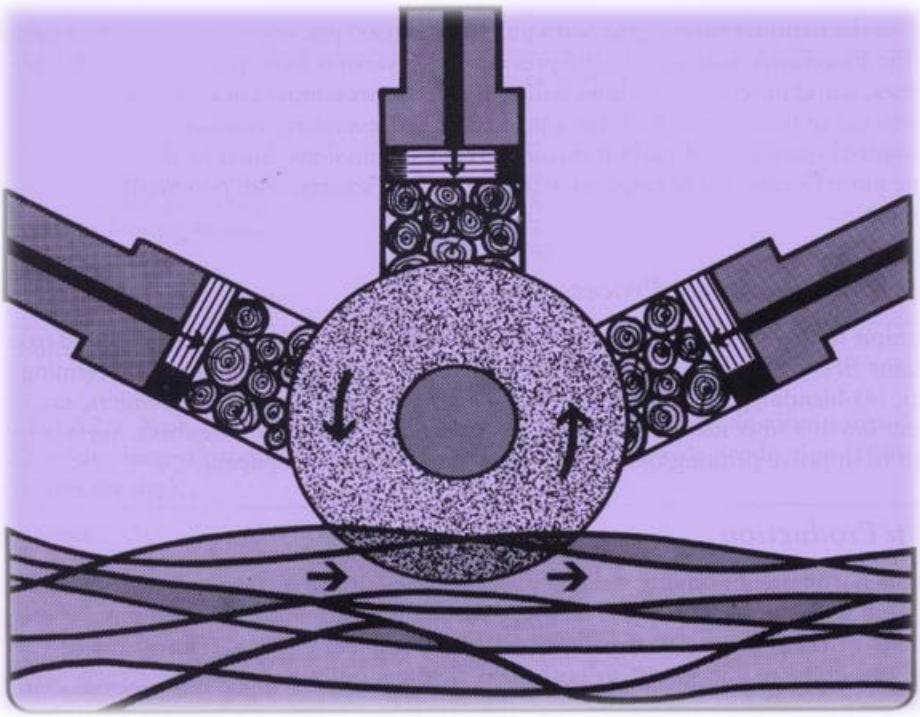




MEHANIČKO PULPOVANJE

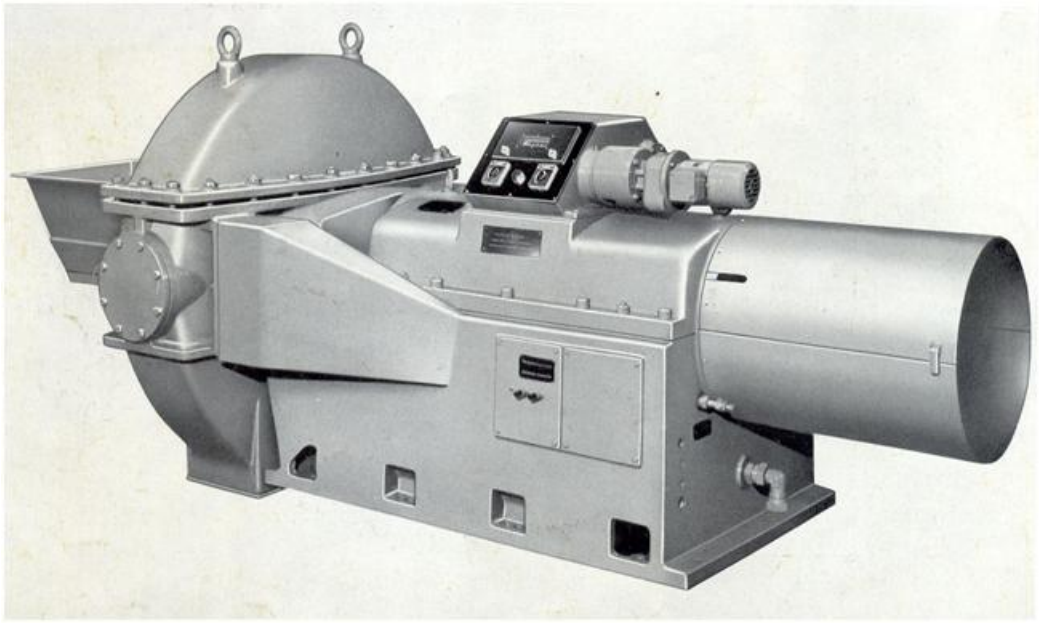
Tehnologija proizvodnje drvenjače



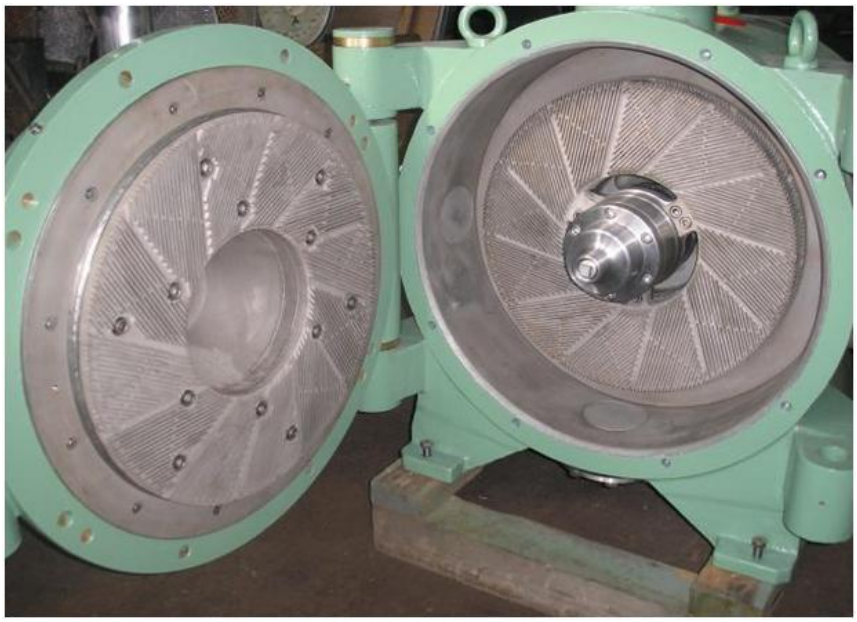


MEHANIČKO PULPOVANJE

Vlakna visokog prinosa



Disk-rafiner



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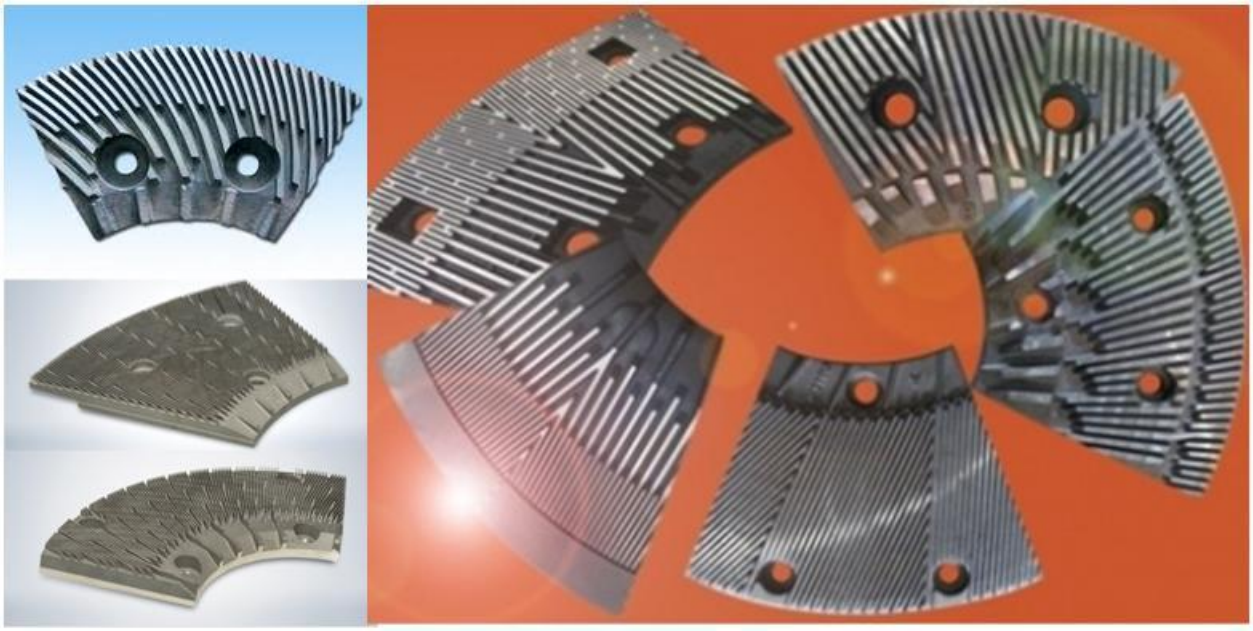
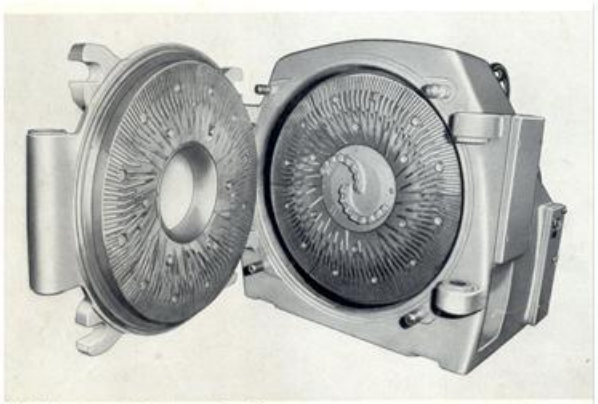
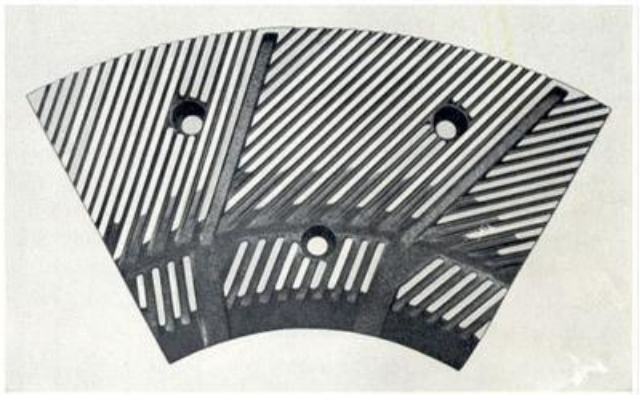
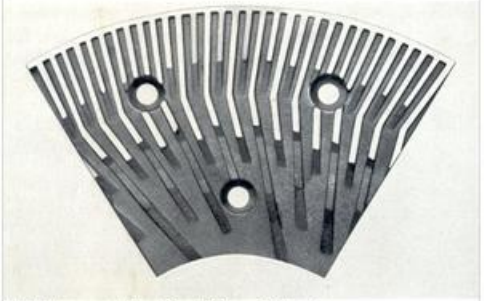




▲ Mahlgarnitur im Scheibenrefiner SZ 1

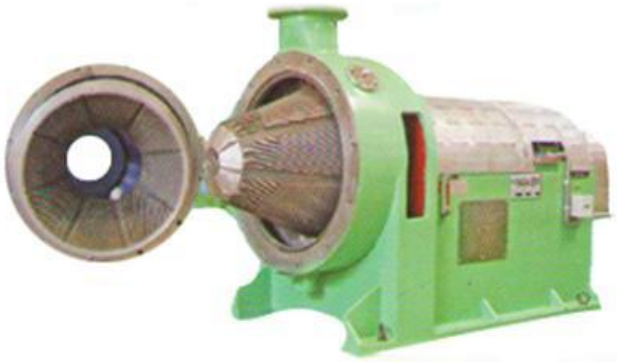


▲ Mahlsegment für Aufschluß von Naßgut

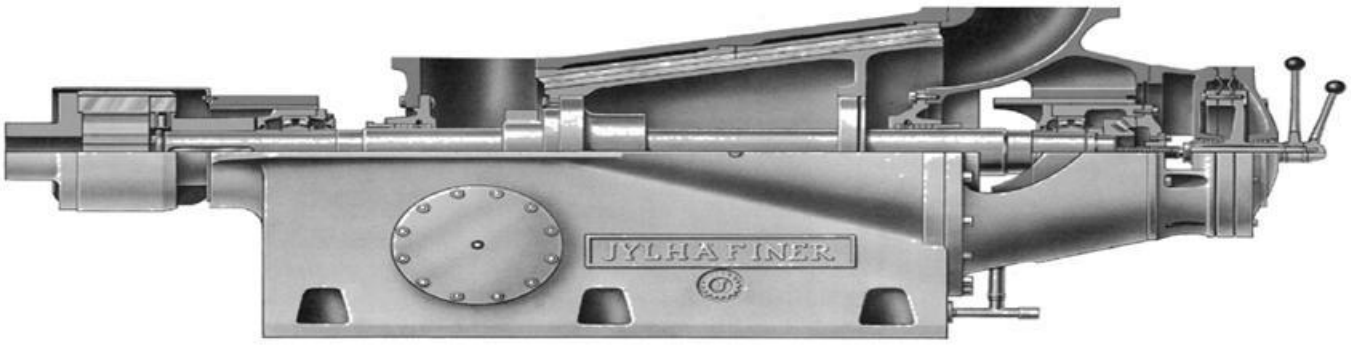


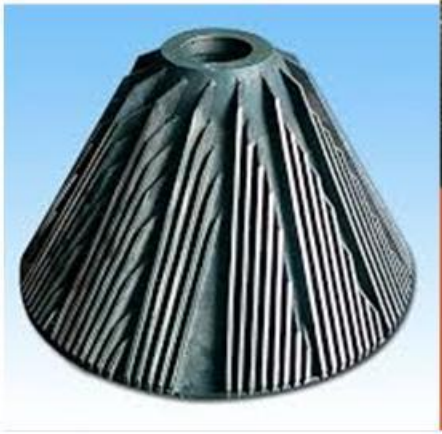
▲ Mahlsegment für Aufschluß von Grobgut

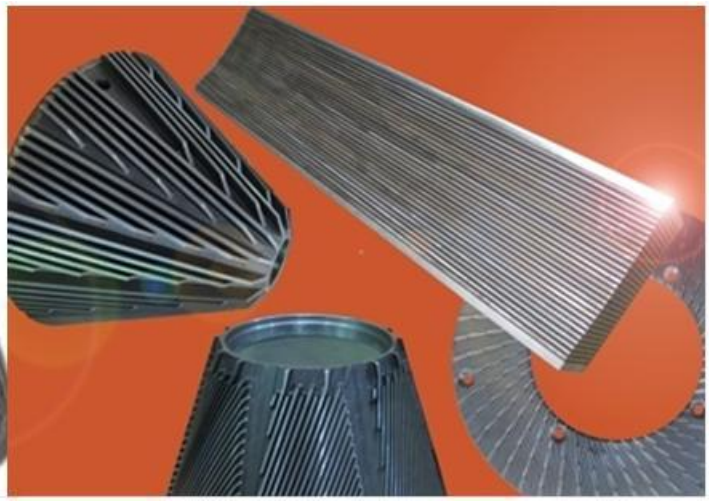
▲ Mahlsegment für Aufschluß von Spänen

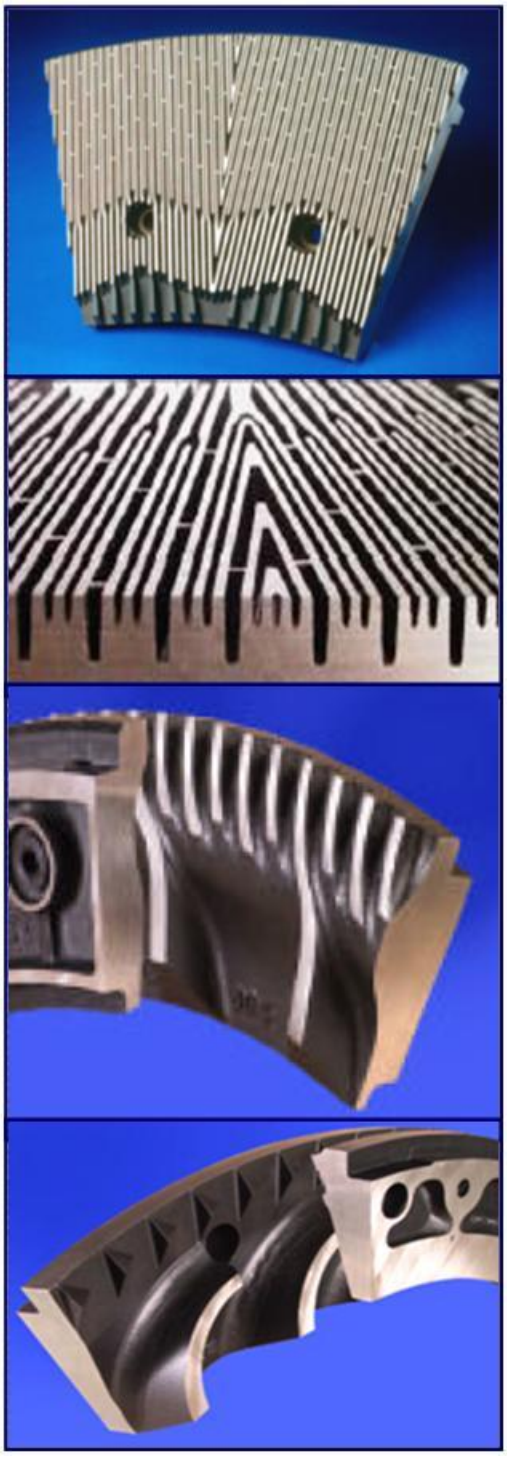


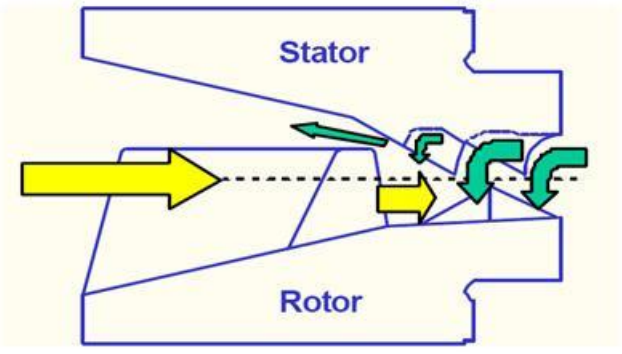
Disk-rafiner konusni



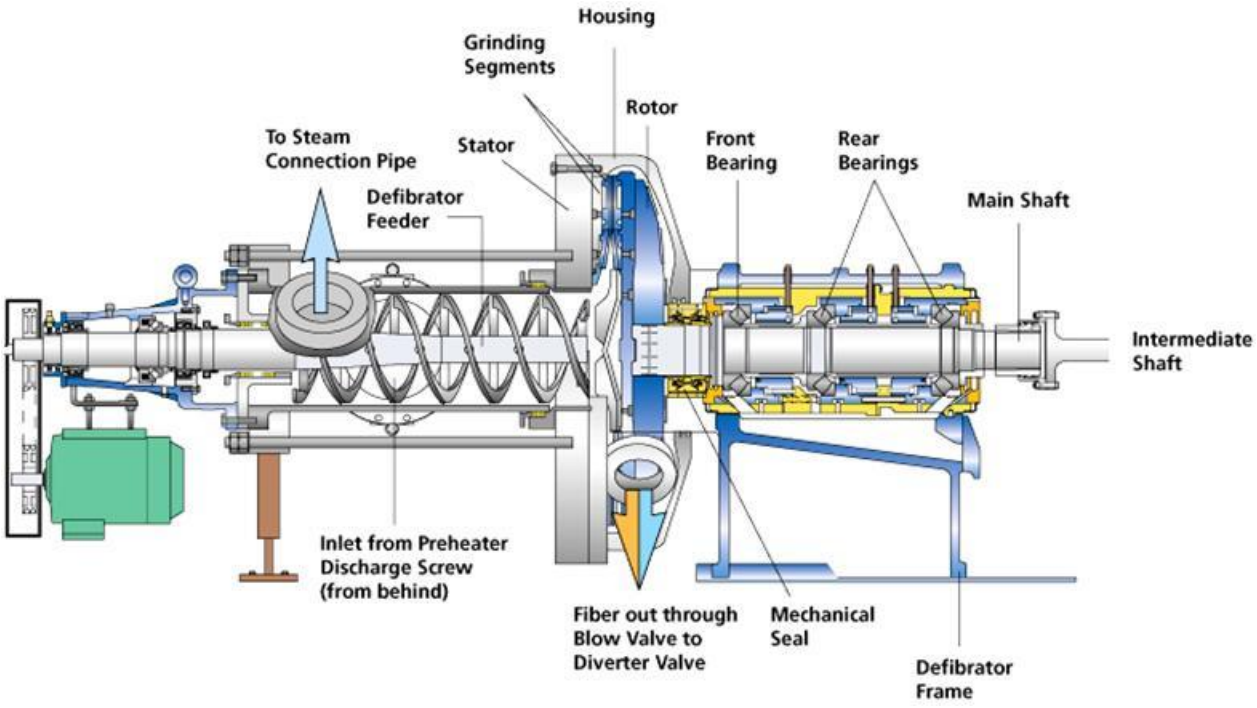




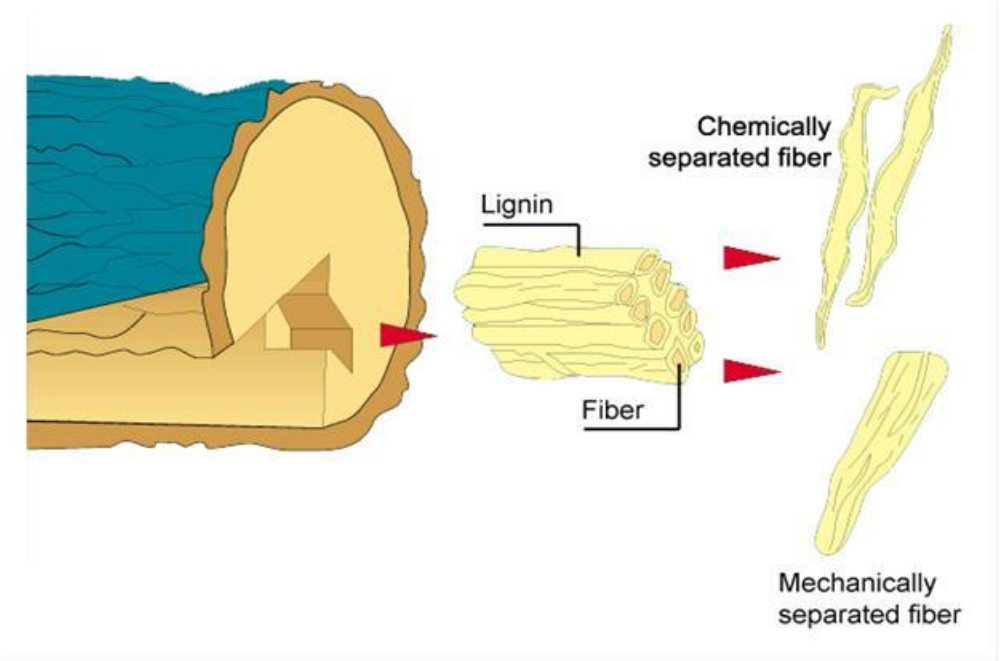


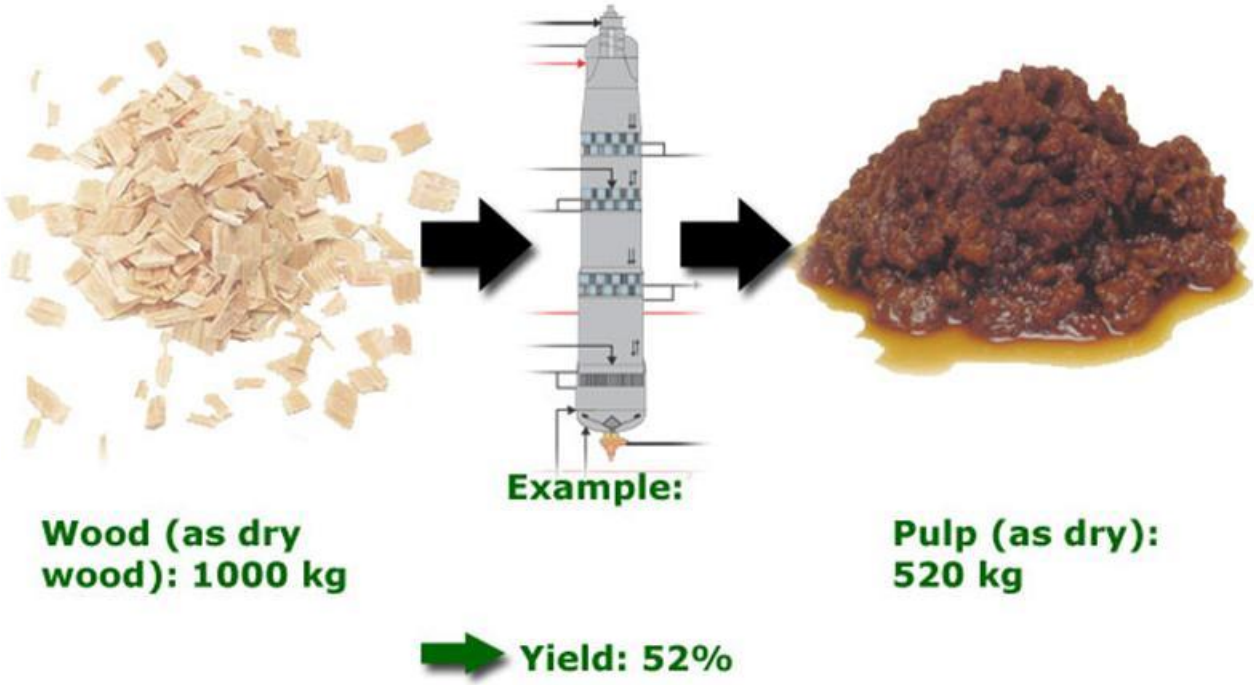

Stator
Rotor

TMP – Termo-Mehaničko Pulpovanje



HEMIJSKO PULPOVANJE

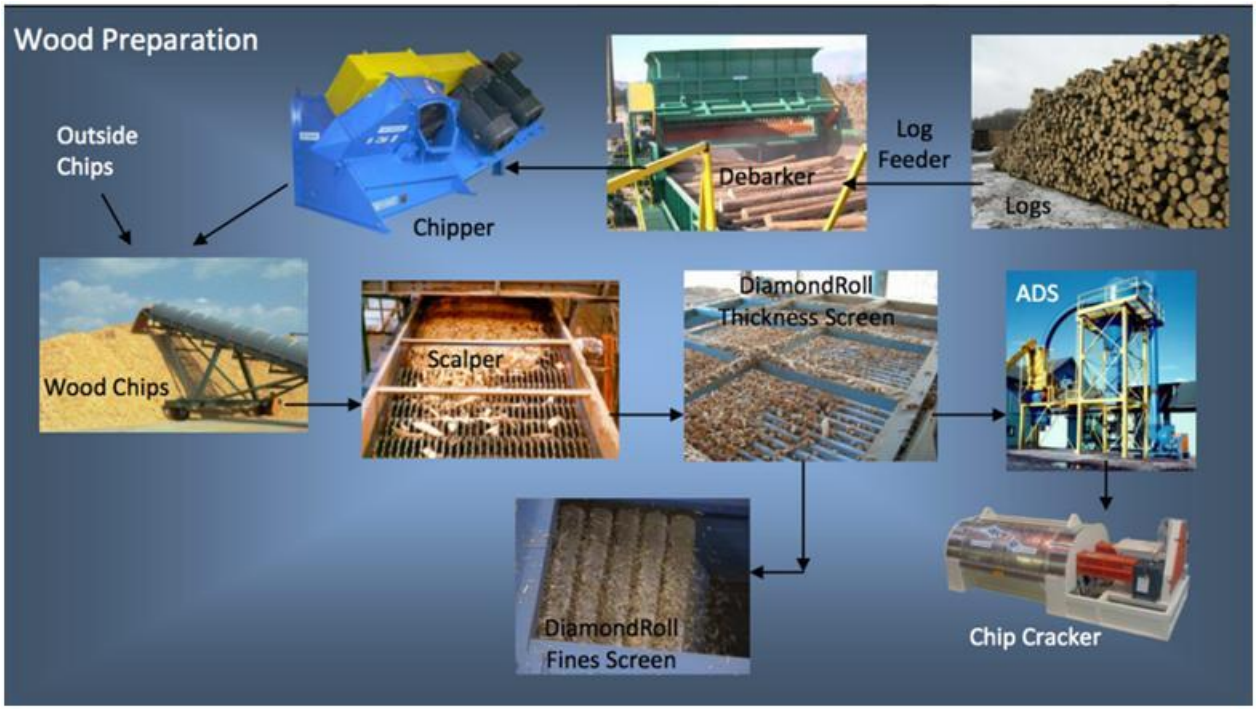


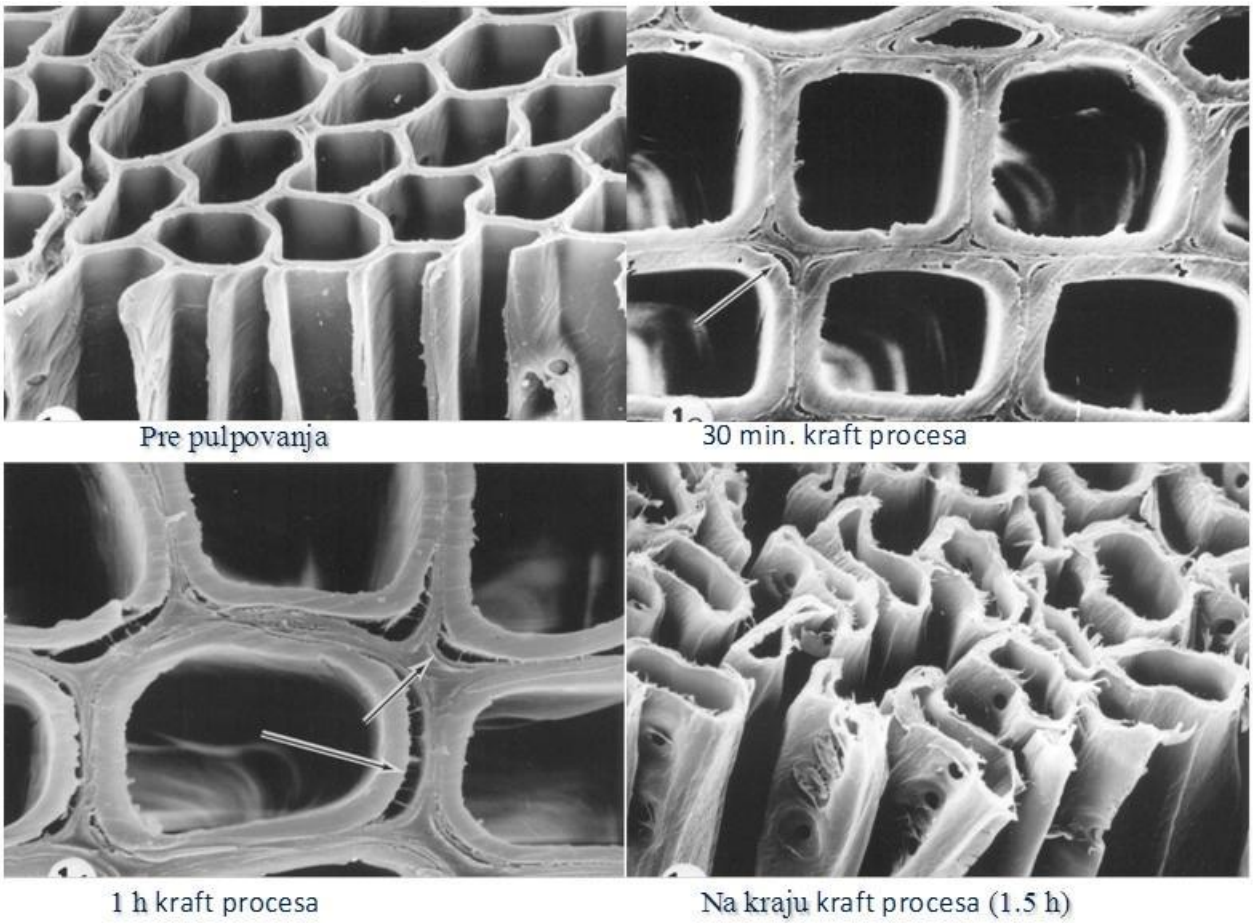


Penetrabilnost odabranih drvnih vrsta

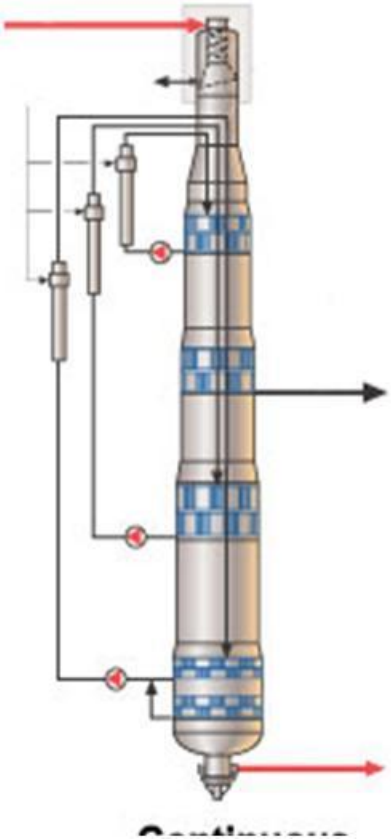
Botaničko ime drveta	Faktor penetrabilnosti x 10^6	
	Beljika	Srčika
Picea mariana	400	70
Picea engelmanni	5	3
Pinus elliottii	6000	10
Pinus palustris	4000	2
Betula papyrifera	1300	450
Fagus grandifolia	1000	0.5
Poulus tremula	5000	4
Populus tremuloides	2500	1

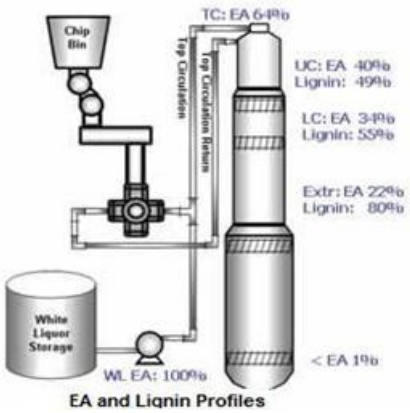
Priprema


Wood Preparation
Outside Chips
Chipper
Debarker
Log Feeder
Logs
Wood Chips
Scalper
DiamondRoll Thickness Screen
ADS
DiamondRoll Fines Screen
Chip Cracker

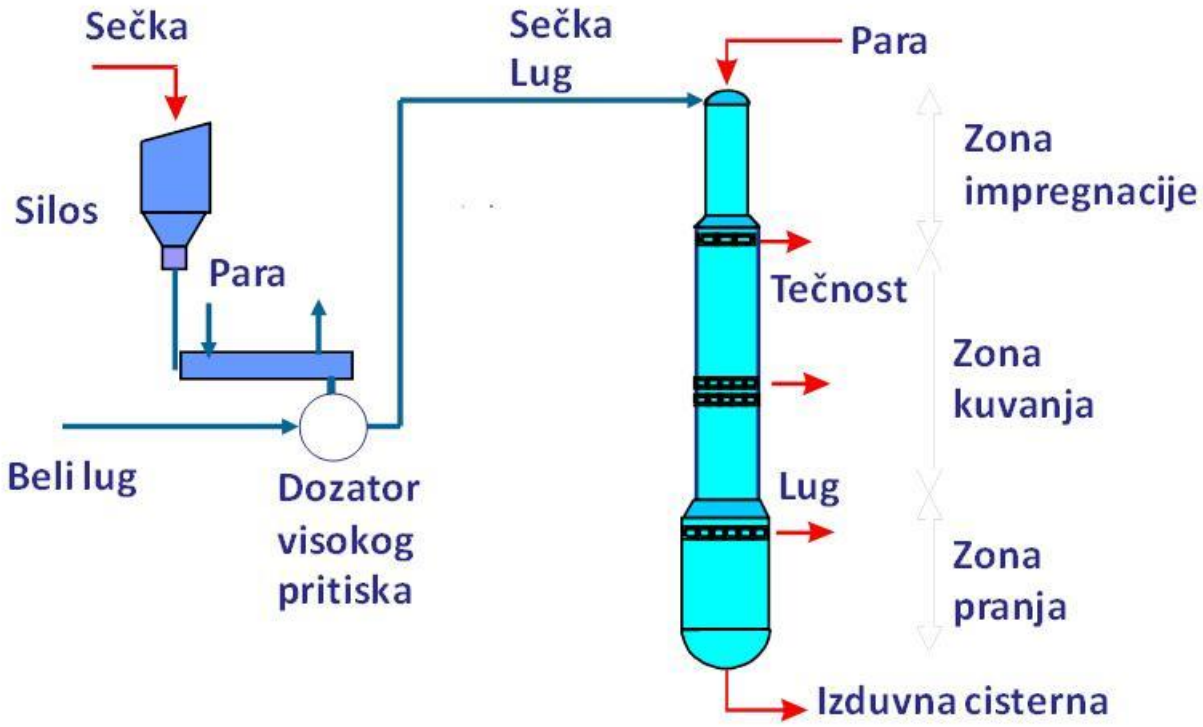


Alkalno - Sulfatno (kraft) pulpovanje

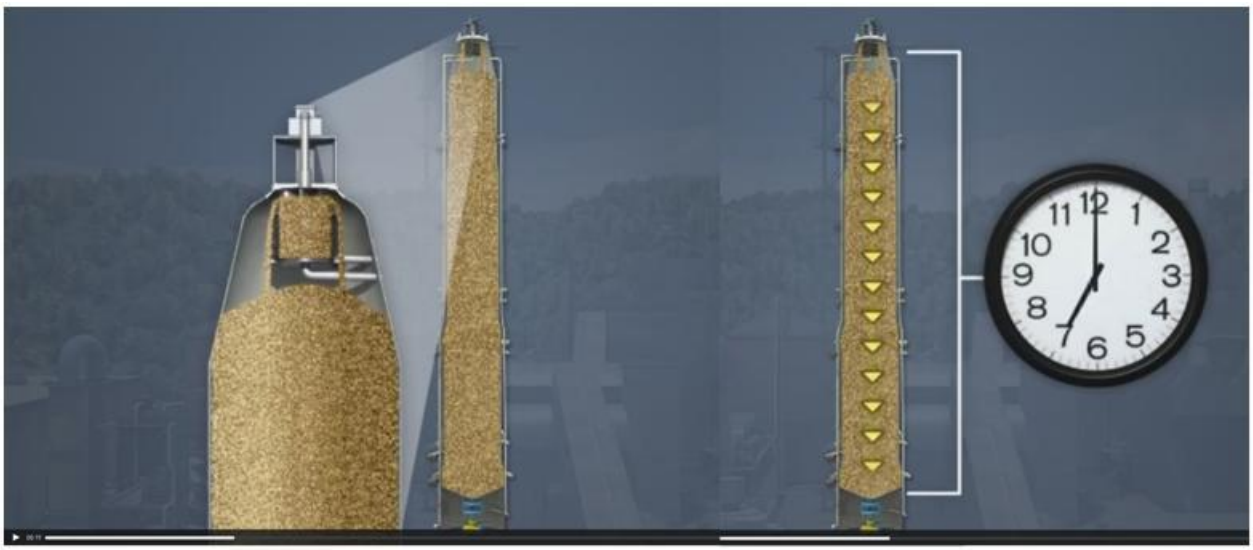




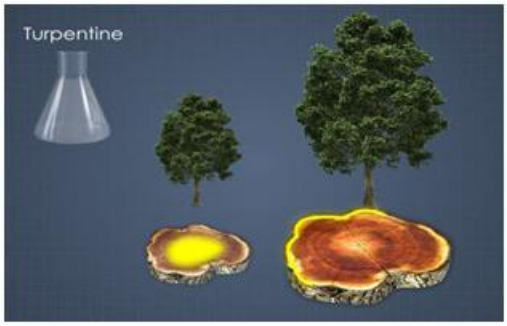
Šaržni kuvač **Kamirov digestor (kontinuelni)**

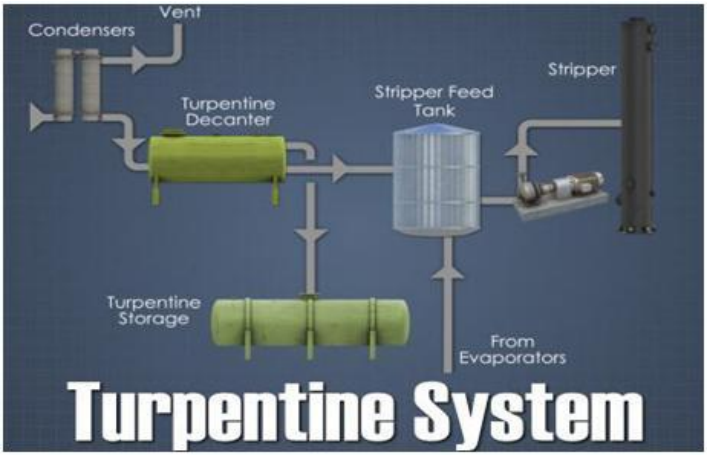


Kamirov sistem za kontinuelno sulfatno pulpovanje

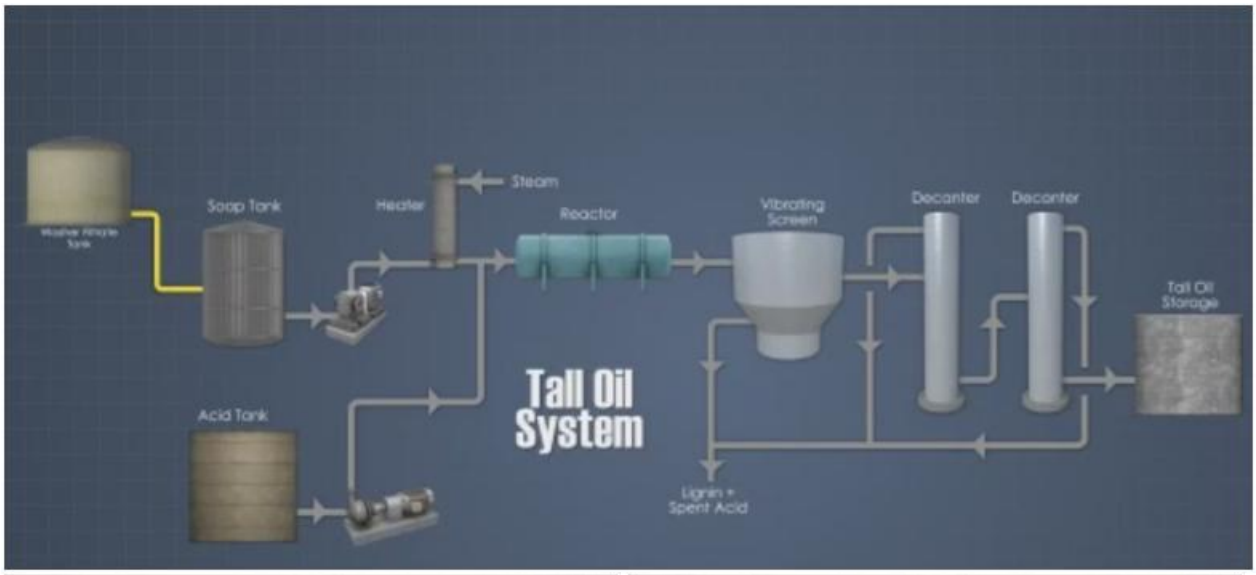


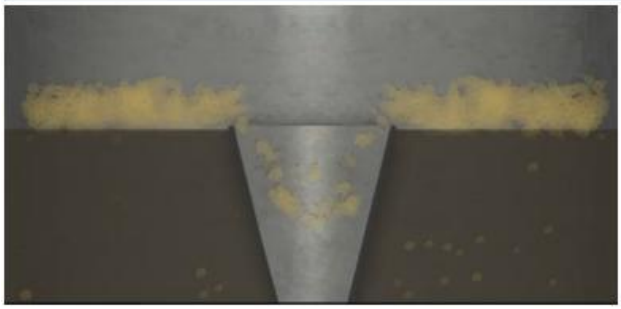
Unutrašnjost kuvača

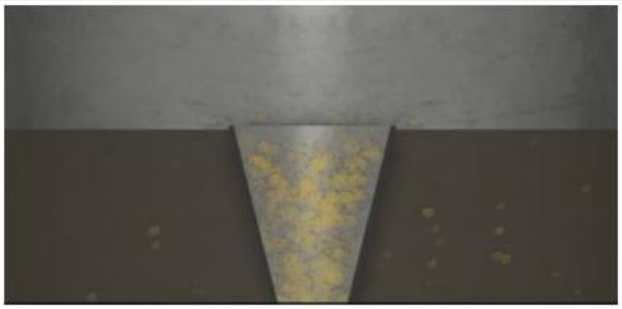




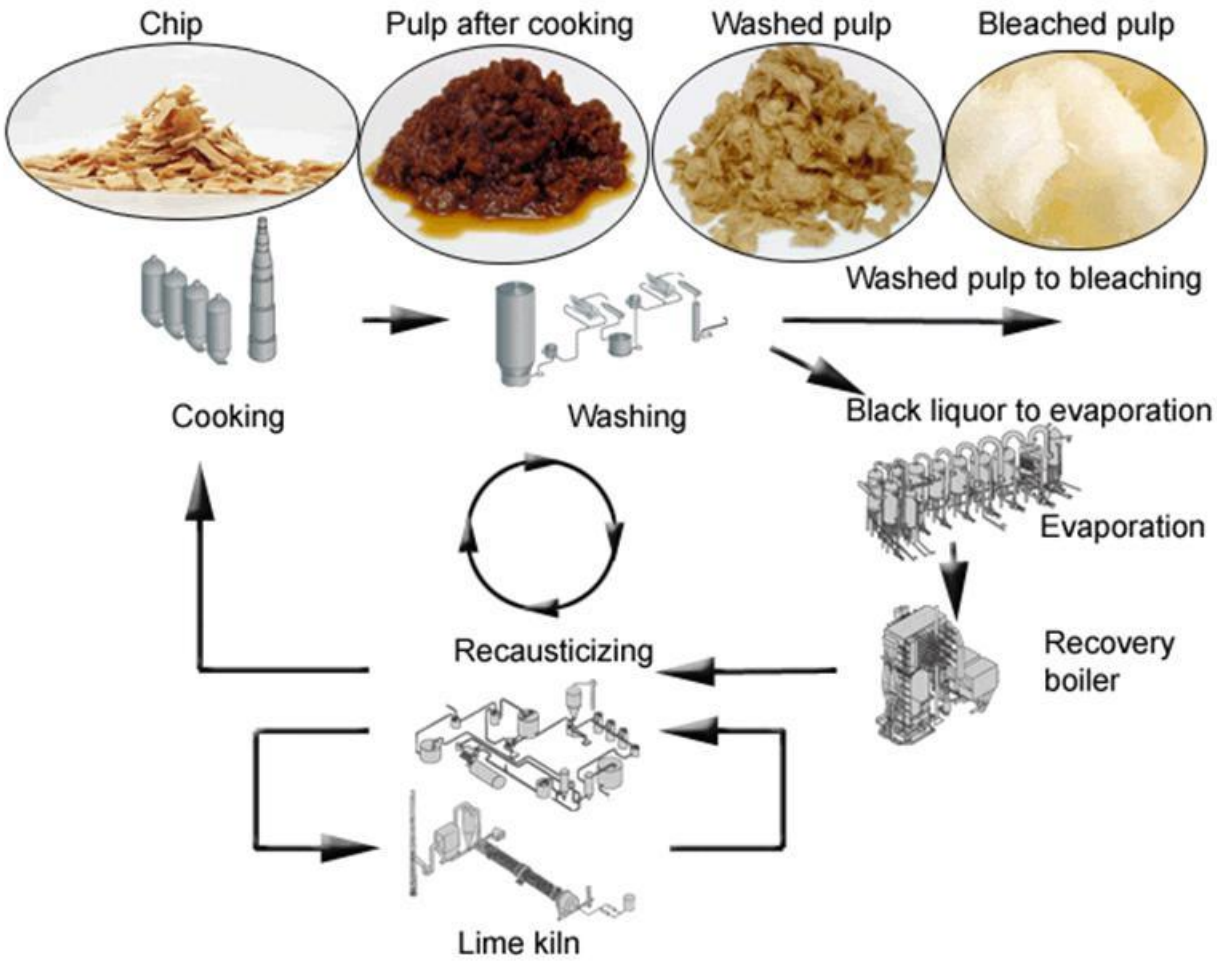
Sulfatni terpentin

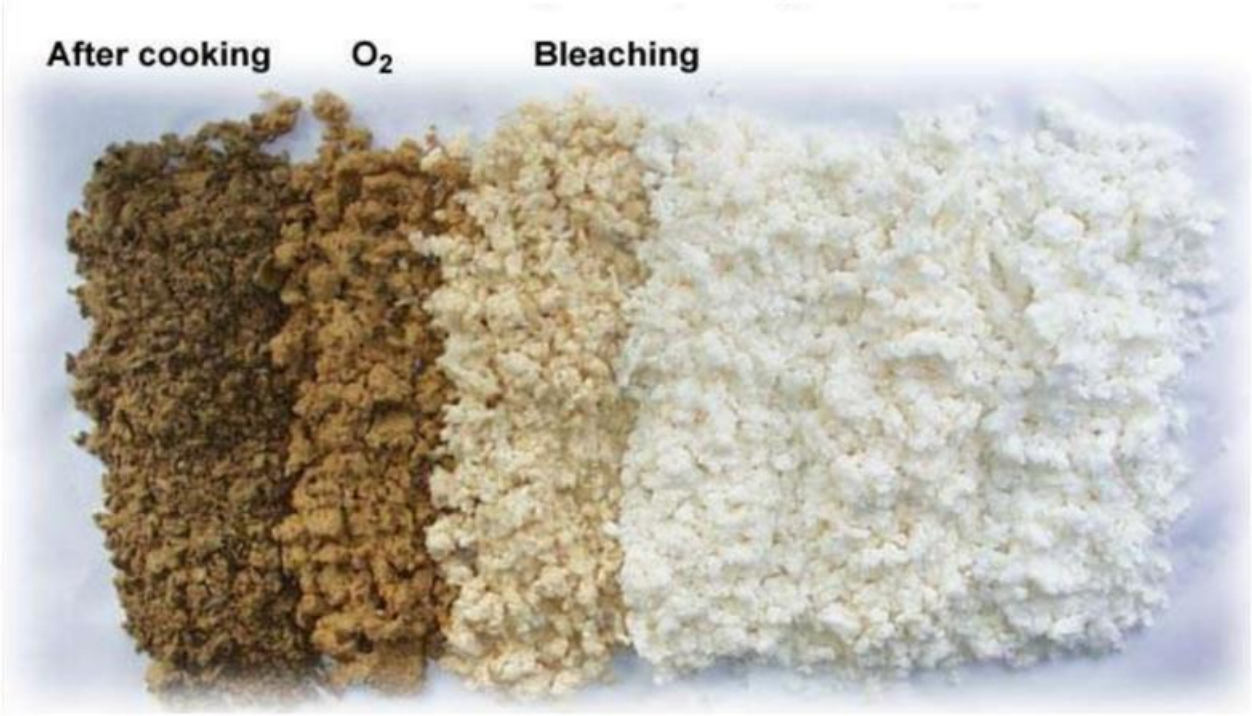




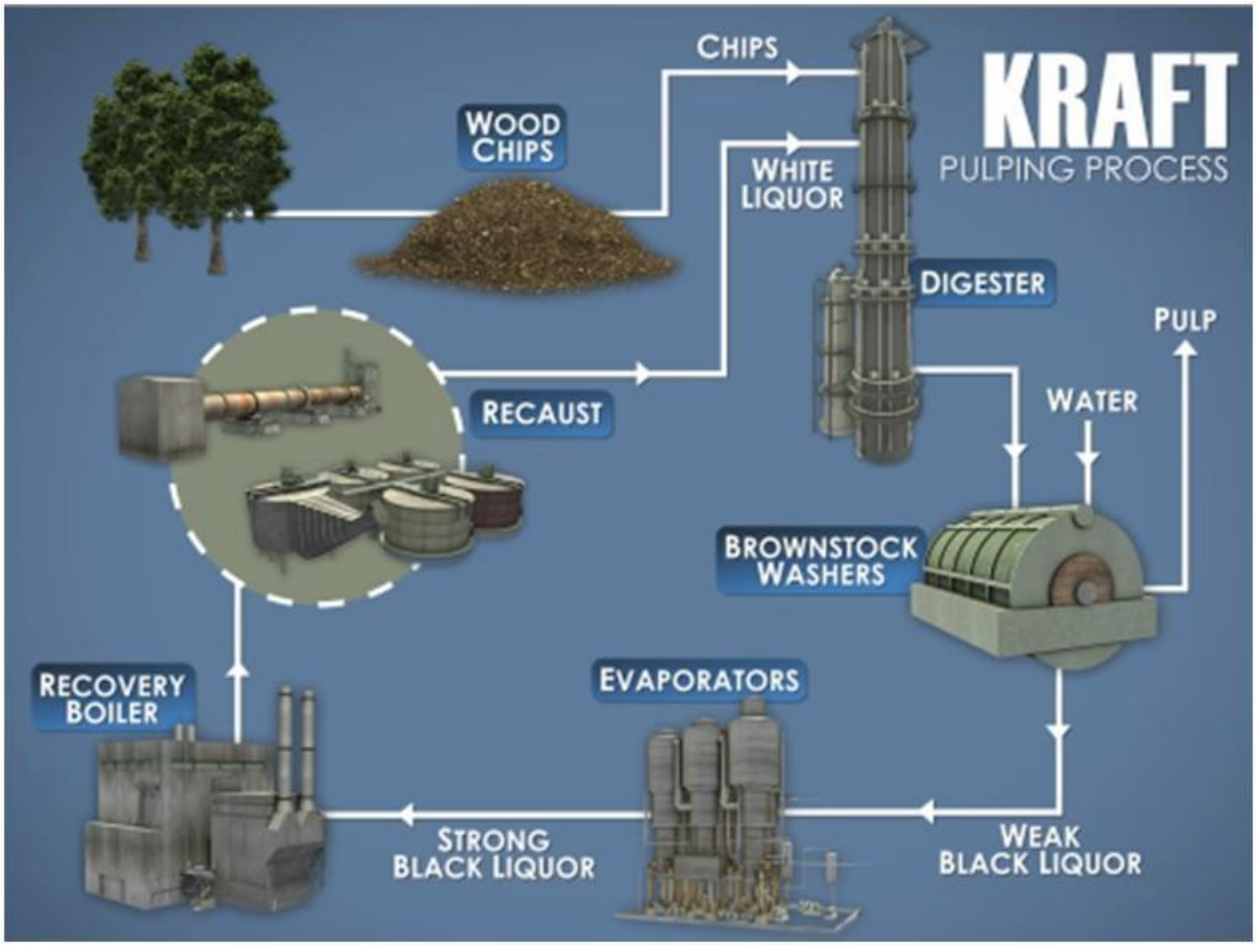


Tal ulje


Chip
Pulp after cooking
Washed pulp
Bleached pulp
Washed pulp to bleaching
Cooking
Washing
Black liquor to evaporation
Evaporation
Recovery boiler
Recausticizing
Lime kiln


After cooking
O_2
Bleaching

Black liquor is separated from pulp in washing

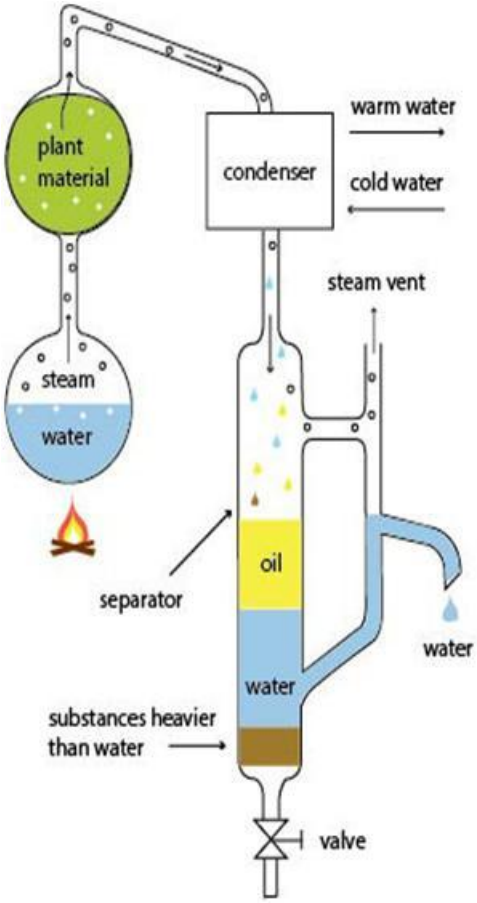


Regeneracija crnog luga

Ekstraktivna industrija

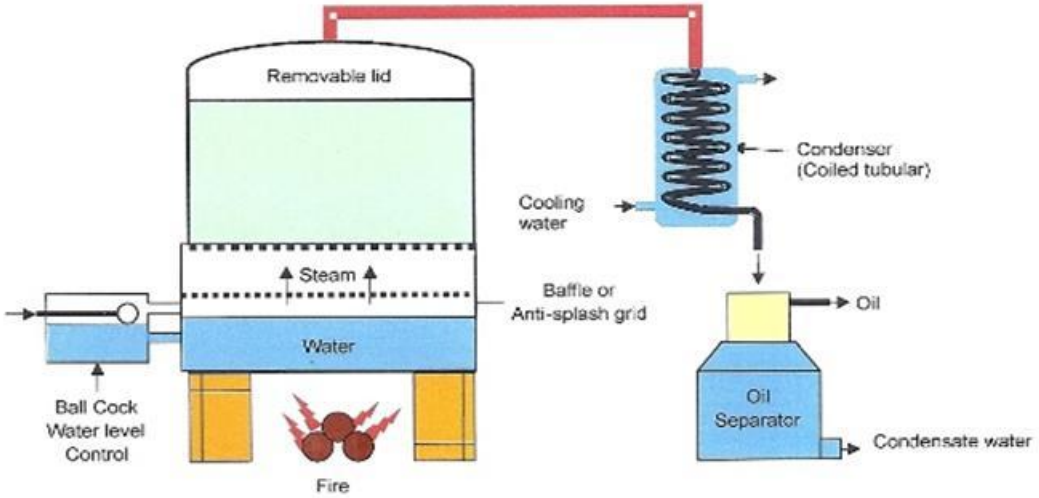
Prerada prečišćene smole

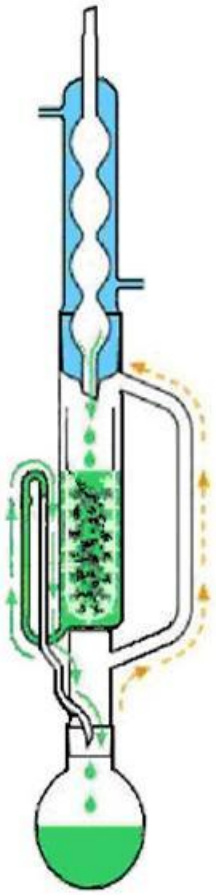
- **Destilacija vodenom parom**



Terpentinsko ulje

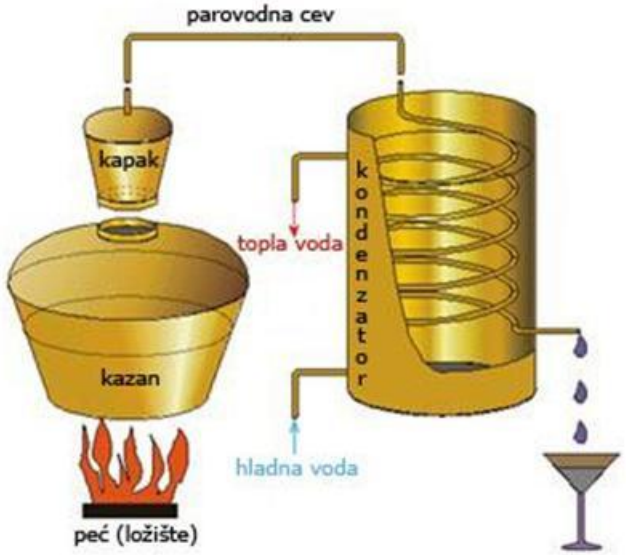
Kolofonijum



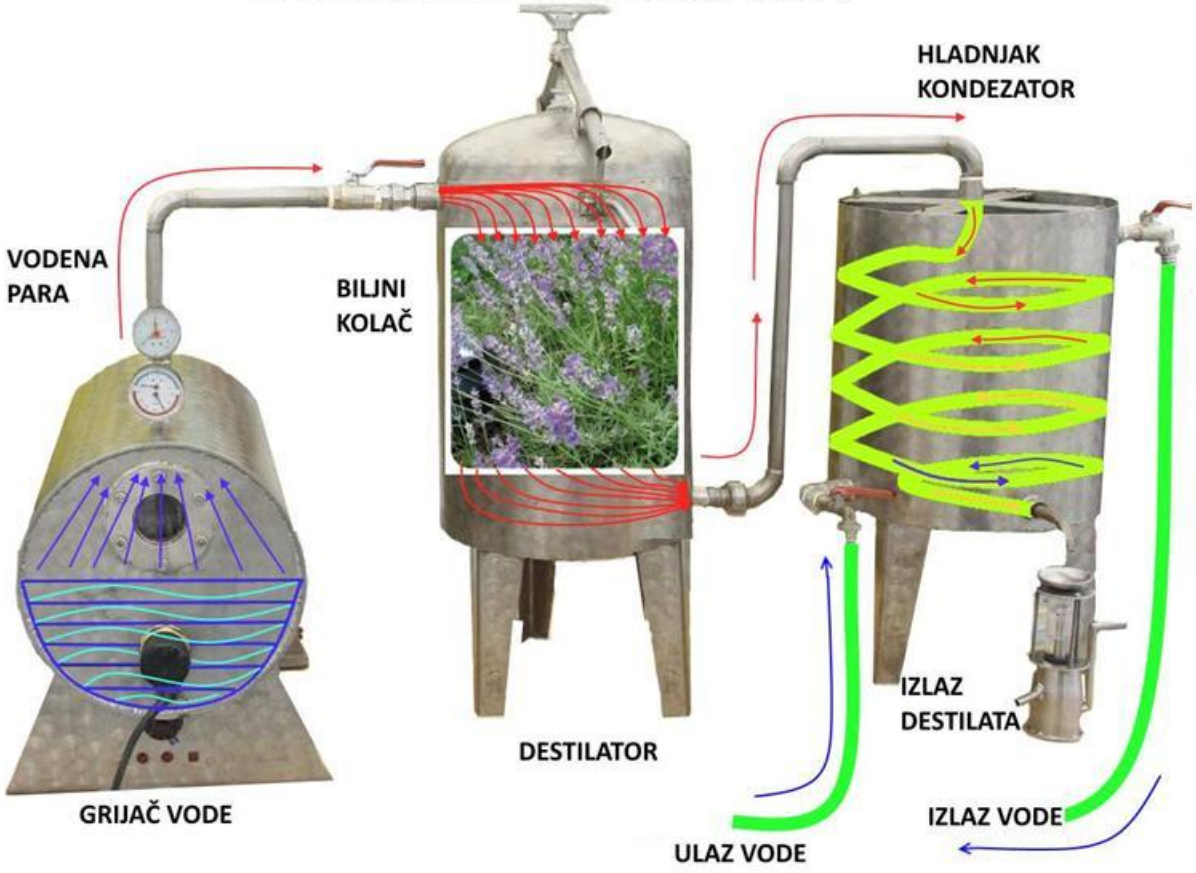


Sokslet aparat (laboratorijski)

Dobijanje etarskih ulja iz četina



DESTILATOR ETERIČNIH ULJA

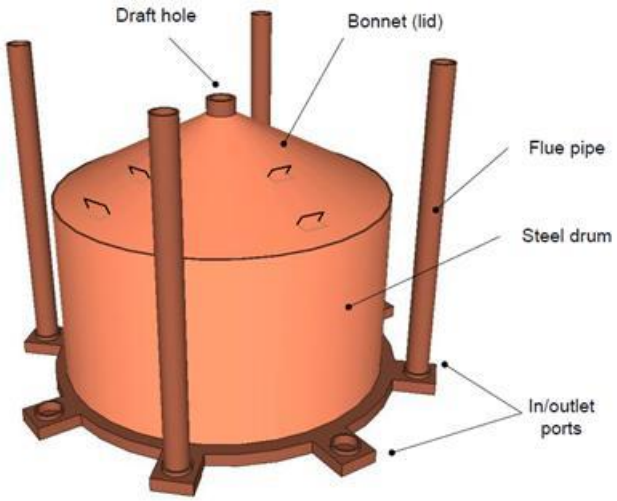


Termička razgradnja drveta

Ugljenisanje (karbonizacija)

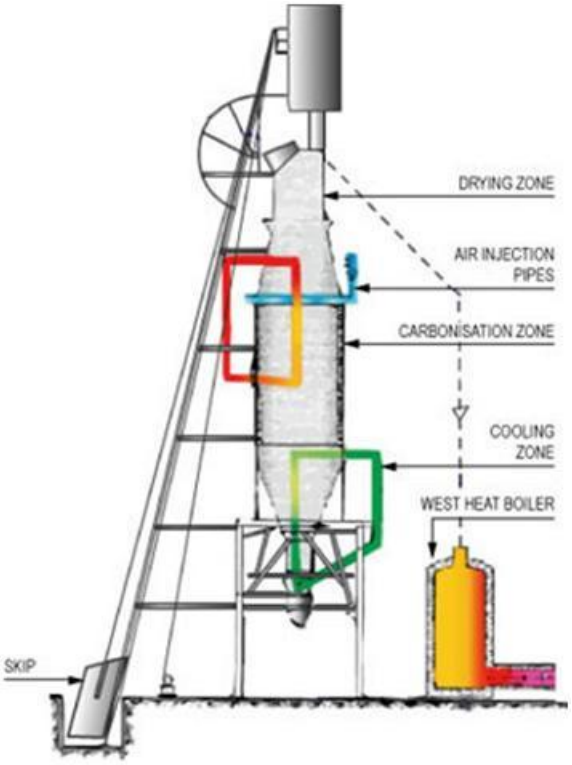
Jame (kope)

Zidane peći

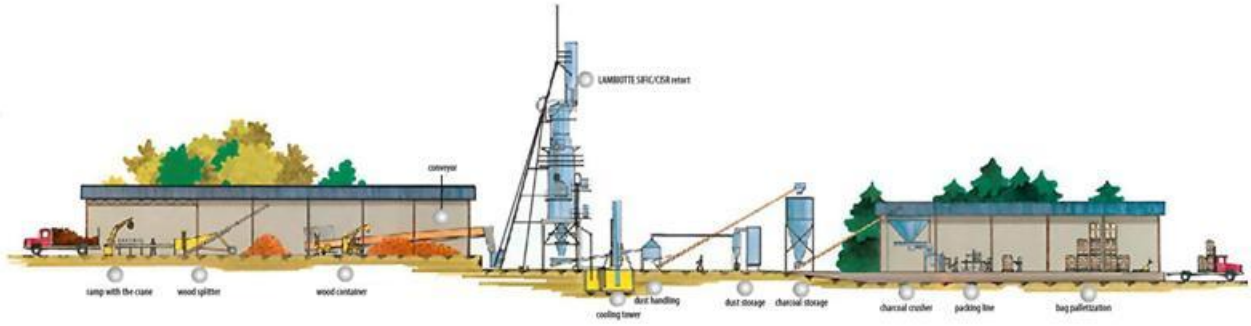


Example of a simple steel charcoal kiln (New Hampshire kiln).

Čelične peći



The SIFIC/CISR retort

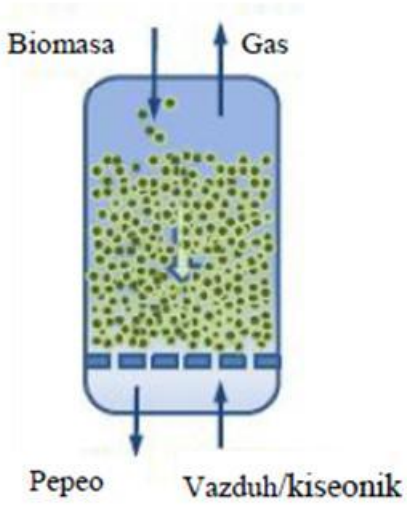


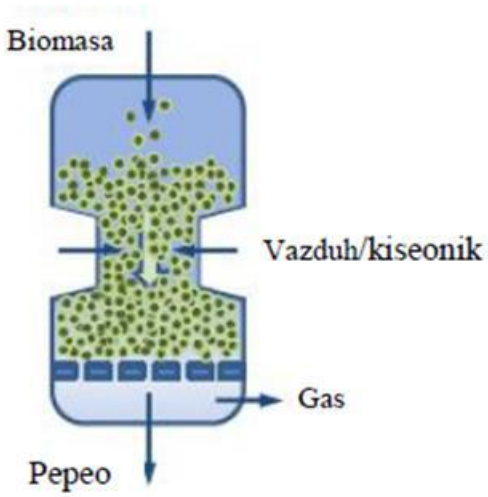
Gasifikacija

Podela gasova iz gasifikatora prema toplotnoj moći

Vrsta gasa	Toplotna moć MJ/Nm^3	Oksidujući gas
Niskokaloričan	4 - 6	vazduh ili vazduh/vodena para
Srednjekaloričan	10 - 15	kiseonik
	13 - 20	kiseonik/vodena para
Visokokaloričan	> 40	vodonik

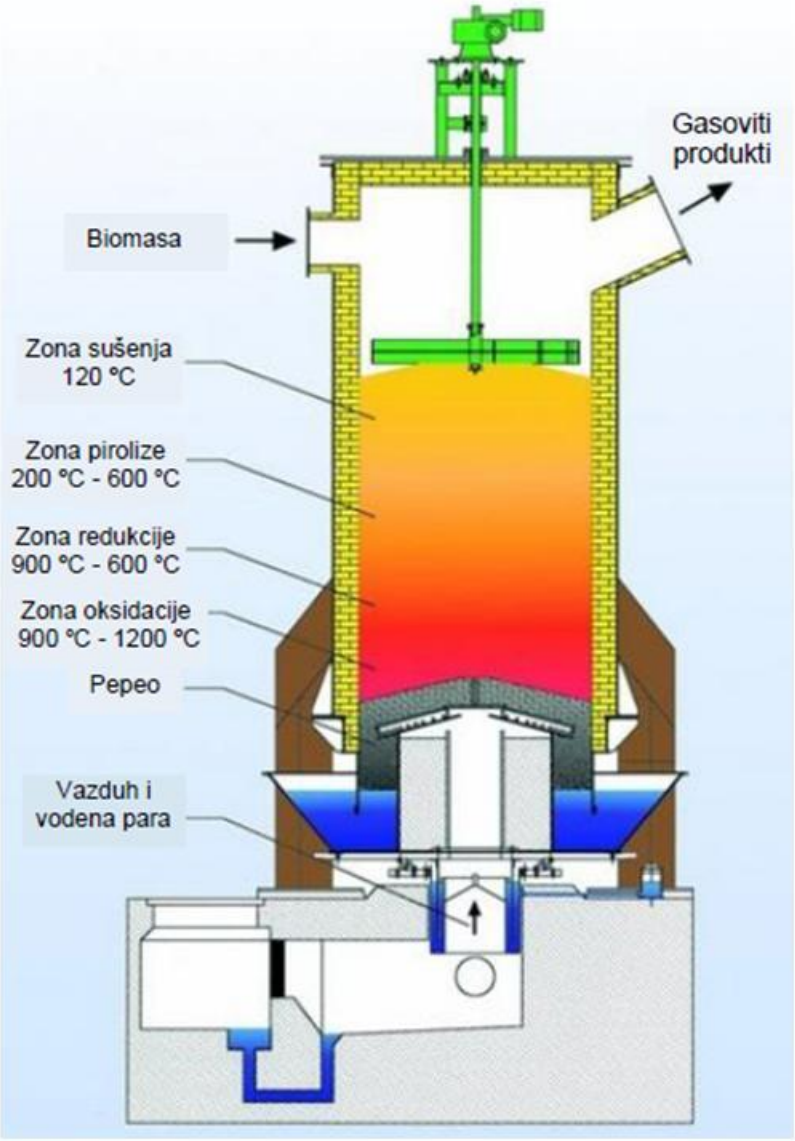
Gasifikator:



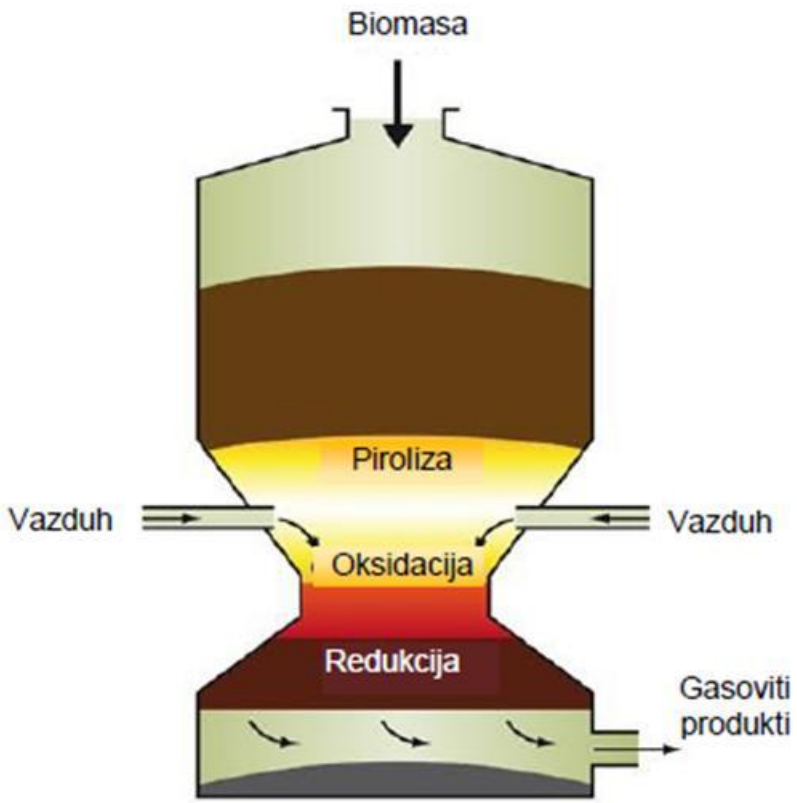


sa uzlaznom strujom oksidanta **sa silaznom strujom oksidanta**

Tip gasifikatora	Smer strujanja		Nosač biomase
	Biogorivo	Oksidant	
Gasifikator sa uzlaznom strujom oksidanta - fiksni sloj	nadole	nagore	rešetka
Gasifikator sa silaznom strujom oksidanta - fiksni sloj	nadole	nadole	rešetka



sa ***uzlaznom strujom***



sa ***silaznom strujom***

Prednosti	Nedostaci
Gasifikator sa fiksnim slojem - uzlazni protok	
▪ Jednostavna konstrukcija, niska cena procesa ▪ Mogućnost korišćenja biomase sa velikim sadržajem vlage ▪ Niska izlazna temperatura gasovitih produkata (oko 200 °C) ▪ Visoka efikasnost konverzije koksa ▪ Visoka toplotna efikasnost ▪ Mali sadržaj čestica u izlaznom gasu	▪ Veliki sadržaj katrana 10 - 20% (maseni udeo) u izlaznom gasu ▪ Limitirana veličina čestica polazne biomase
Gasifikator sa fiksnim slojem - silazni protok	
▪ Jednostavna konstrukcija, niska cena procesa ▪ Maksimalno dozvoljen sadržaj vlage u sirovini 35% (maseni udeo) ▪ Izlazni gasoviti produkti sadrže katran u tragovima i nije potrebno njegovo uklanjanje	▪ Ograničena veličina čestica sirovine i sadržaj pepela ▪ Visoka izlazna temperatura gasova (oko 1000 °C) što dovodi do potrebe za dodatnim hlađenjem ▪ Ostaje nekonvertovano 4 - 7% ugljenika