Chapter 4

New Technology in High Yield Pulping

4.1 General Description of High Yield Pulping

(1)Varieties of high yield pulp

	yield (on wood)%
Mechanical pulp	>90
Chemimechanical pulp	80~92
Semichemical pulp	65~80
High yield chemical pulp	50~65

(2) Significance of developing high yield pulp

- Fully and reasonably utilize fibrous materials
- Reduce production cost
- Meet the property requirement of some products
- Decrease the pollution of pulping spent liquor

(3)Developing tendency of high yield pulping

- High yield
- High strength
- High brightness
- Low energy consumption
- Low pollution

(4) Technical terms

SGW -- Stone Groundwood
PGW -- Pressurized Groundwood
PGW-S -- Super Pressurized Groundwood
TGW -- Thermogroundwood
CGP -- Chemical Groundwood Pulp
FGP -- Fine Groundwood Pulp
RMP -- Refiner Mechanical Pulp
TMP -- Thermo-Mechanical Pulp

CMP -- Chemi-Mechanical Pulp

CTMP -- Chemi-Thermo-Mechanical Pulp

APMP -- Alkaline Peroxide Mechanical Pulp

SCMP -- Sulfonated Chemimechanical Pulp

BioMP -- Bio-Mechanical Pulp

SEP -- Steam Explosion Pulp

EMP -- Extruder Mechanical Pulp

SCP -- Semi-Chemical Pulp

NSSC -- Neutral Sulfite Semi-Chemical Pulp

ASSC -- Alkaline Sulfite Semi-Chemical Pulp

(5) Main characters of Mechanical pulp

- High opacity and light scattering coefficient
- Excellent printability (ink absorption)
- Good smoothness due to high content of fine
- High bulk which results in good stiffness of paper and paper board
- Good formation and dimension stability

(6) Main uses of mechanical and chemimechanical pulps

- Newsprint
- As a furnish of printing and writing paper
- As a furnish of supercalendering paper (SC) and light weight coated paper (LWC)
- As a furnish of paperboard
- Tissue and fluff pulp

4.2 Improvement of Stone Groundwood – PGW and PGW-S

(1)Comparison of technological parameters of SGW、PGW and PGW-S

	SGW	PGW	PGW-S
Linear speed of pulpstone m/s	17~24	28	28
Grinding pressure KPa	Atmosphere	250	450
Temp. of shower water ℃	60~70	105	140
Temp. of pulp ℃	75~85	109	139

(2) Comparison of specific energy consumption of PGW、PGW-S and TMP

	PGW	PGW-S	TMP
Grinding/refining KWh/t	**1065**	**1030**	**1490**
Reject refining KWh/t	**95**	**110**	**130**
Post refining KWh/t	**—**	**—**	**15**
Total KWh/t	**1060**	**1140**	**1635**

*65ml CSF

(3) Comparison of pulp property of PGW、PGW-S and TMP

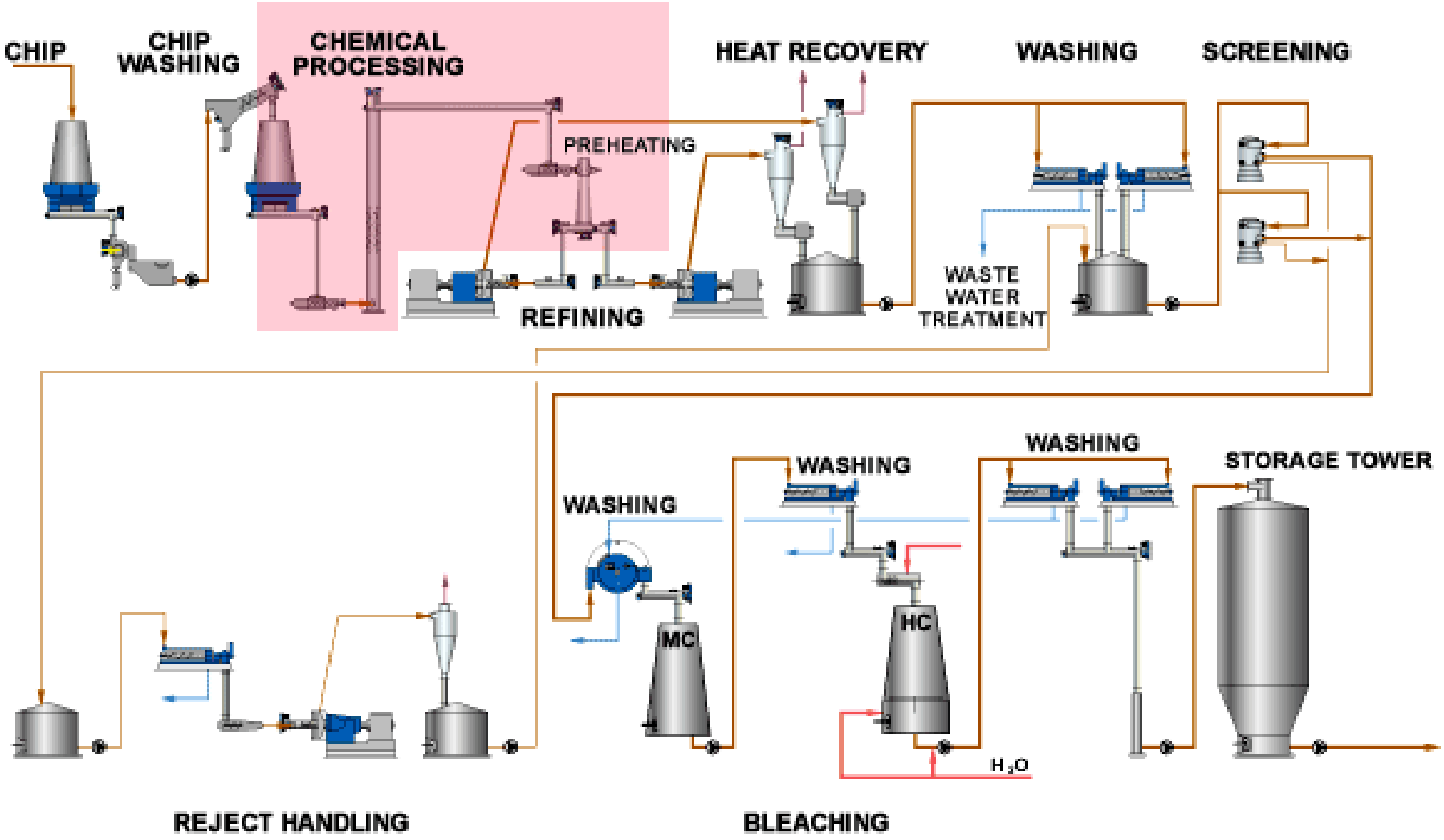
		PGW	PGW-S	TMP
CSF (ml)		112	112	112
Reject %		2.74	4.25	0.18
Classification				
	R28 %	28.3	32.9	33.4
	P200 %	30.3	28.8	28.1
Tensile index	Nm/g	30.1	31.6	29.2
Tear index	$mN \cdot m^2/g$	5.1	5.6	6.1
Burst index	$kPa \cdot m^2/g$	1.7	2.1	2.3
Light scattering coefficient	m^2/Kg	63.0	60.8	54.4
Brightness	%ISO	64.0	59.7	59.4
Density	kg/m^3	350	354	377

(4) Summary

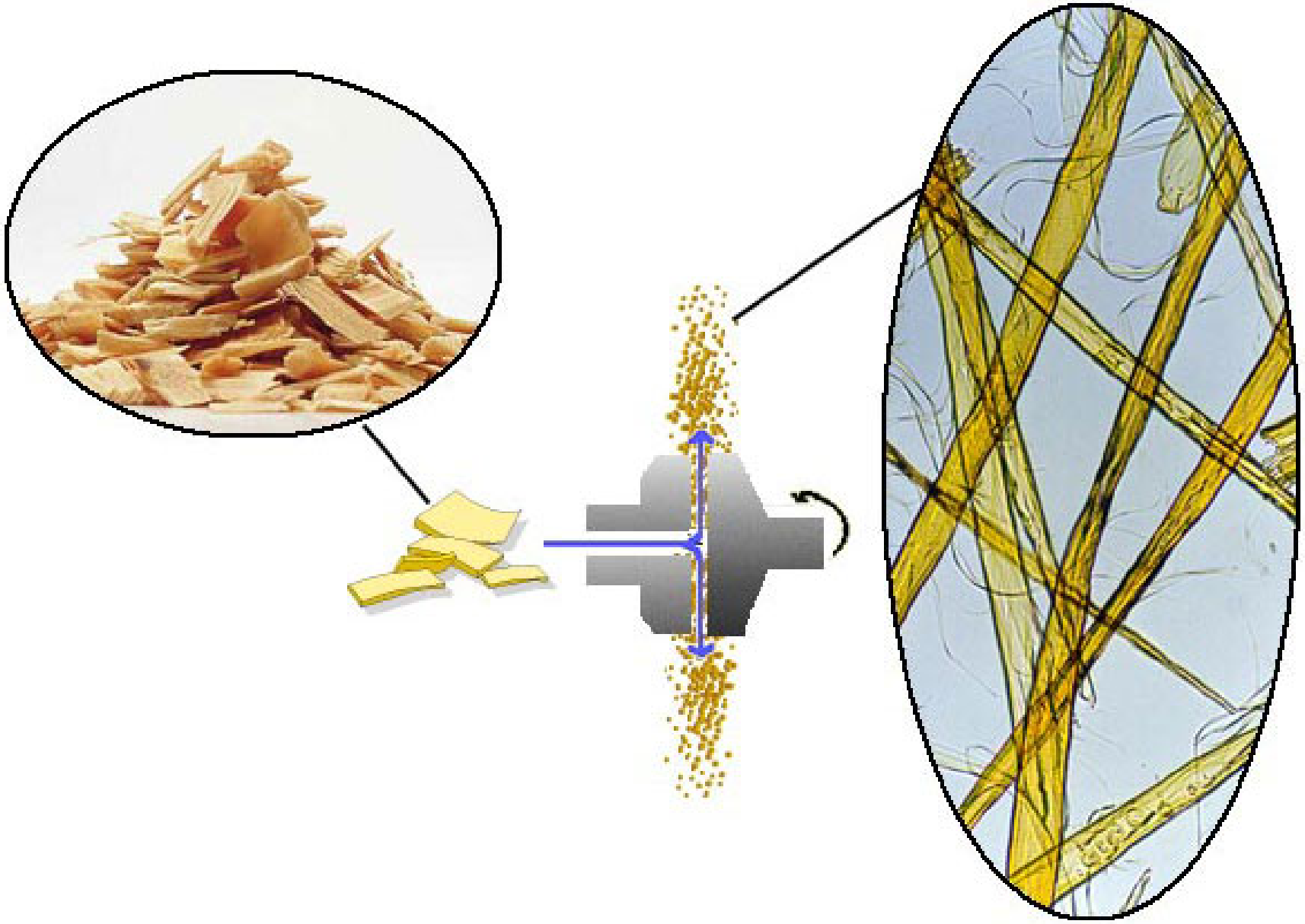
- The energy consumption of PGW-S is similar to that of PGW, but much lower than that of TMP.
- The long fiber content of PGW-S is higher than that of PGW, and similar to that of TMP.
- The strength of PGW-S is much higher than that of PGW, the tensile and burst strength are close to TMP.

- Light scattering coefficient of PGW-S is lower than that of PGW, but is much higher than that of TMP
- The brightness of PGW-S is similar to that of TMP, but the bleachability is much better than that of TMP
- The linting phenomena of stone groundwood are obviously less than that of TMP

CTMP PROCESS DIAGRAM



Pulp production by refining



4.3 Improvement of TMP Technology –RTS TMP

RTS Refining Technology

R—residence time

T—temperature

S—speed

Optimized technology

-short residence time

-elevated temperature

-high speed

Objective of the modified technology

increase selectively the temperature of secondary wall, but does not increase the temperature of middle lamella.

Comparison of TMP and RTS-TMP for newsprint

	TMP	RTS-TMP
CSF ml	90	90
Specific energy consumption KWh/t	2198	1878
Bulk cm^3/g	2.38	2.38
Burst index kPa • m^2/g	2.8	2.90
Tear index mN • m^2/g	9.5	9.5
Tensile index Nm/g	46.6	47.2
Tensile energy absorption J/m^2	47.1	49.7
Shive %	0.2	0.13
Opacity %	93.5	93.4
Light scattering coefficient m^2/Kg	55.9	58.2
Brightness %ISO	59.8	61.5

Advantages of RTS-TMP compared with TMP

- Less energy consumption
- Slightly higher strength at the same CSF
- Much less shive
- Higher light scattering coefficient
- Higher brightness

4.4 Improvement of CMP-APMP&PRC-APMP

APMP——a revolution in high yield pulping

(1)Process description

- Two stages of impressafining (with impressafiner)
- Two stages of impregnation
- Two stages of atmospheric refining

(2)Chemicals used in APMP

First stage: small amount or residual NaOH and H_2O_2 ,DTPA

Second stage: NaOH

H_2O_2

DTPA

(3) Advantages of APMP

- The pulp requires no additional bleaching after refining, the cost of building a plant can be reduced by 25% or more.
- The impressafiner can squeeze out high levels of resins and water soluble materials from the chips

- Simple atmospheric refiners can be used, thus eliminating the need for extensive steaming systems
- The use of more caustic on the chips prior to refining reduces the energy consumption up to 40%
- Since the process does not use sulfite, the effluent from the plant will be easier to treat

Improvement of APMP——PRC-APMP

P—Preconditioning

RC—Refiner chemical

APMP—Alkaline peroxide mechanical pulp

4.5 Latency and Delatency of High Yield Pulps

(1) Reasons of generating latency

- High consistency
- High temperature soften the fiber
- Fiber torsion and curling, as temperature lowers out of refiner, the fibers keep the situation of torsion and curling

(2) Delatency

- Higher temperature 70~90℃
- Lower consistency 2%~4%
- Stirring a certain time 30min

(3) Maximum changes observed after delatency

- Shive content -75%
- CSF -(100~150)ml
- Tensile index +(30%~100%)
- Tear index +15%

4.6 Comparison of several high yield pulps

In general, for the same fibrous material

Yield: SGW>RMP>TMP>CTMP>CMP

Strength: SGW<RMP<TMP<CTMP<CMP

Brightness: TMP<PGW<SGW

Brightness of CTMP and CMP depends on the chemicals and technological conditions

Opacity: SGW>PGW>RMP>TMP>CTMP>CMP

Refining energy (at the same CSF):

PGW<SGW<RMP<TMP<CTMP