




**KUMAR METAL INDUSTRIES PVT. LTD.**  
In Joint Venture with  
**CROWN IRON WORKS, USA.**



**CRUSHING TECHNOLOGY  
FOR EXTRUDED SOYBEAN**

**Presented By: Rajesh Soni  
Project Manager**

**KUMAR METAL INDUSTRIES PVT. LTD.**



## Corporate Overview

- ❑ Established in the year 1939
- ❑ Corporate Head Quarters located in Mumbai
- ❑ Complete solution provider to the oilseed crushing, solvent extraction oil refining, and Biodiesel industry
- ❑ Our presence across 60 countries and serve over 500 customers







## Our Mission

To provide premium service, equipment and process technology, which in turn produces a quality end product that helps to promote our customer's business.





### Joint Venture Operations






KMIPL is in technical collaborations with Crown Iron works company USA : a world leader in oil extraction and refining plants.






### Certification & Recognition



- ISO 9001-2015 Certification  
 Our Quality Assurance System is certified in compliance with ISO 9001-2015 by Notifying Body TUV NORD
 


  
- CE-PED & Machinery Certification  
 Kumar Metal Industries is approved to design and manufacture pressure vessels in compliance with the European Council's Pressure Equipment Directive 97/23/EC & Machinery Directive 98/37/EC, by the European Notifying Body
 


  
- ATEX  
 Testing and certification of all equipment to be used in a potentially explosive atmosphere are approved under the ATEX Directive 94/09/EC, by the European Notifying Body
 


  
- Approval for Australia and New Zealand codes
 



**Kumar Infrastructure**





Kumar's manufacturing & fabrication units span across 22,762 sq. meters, house over 400 skilled technicians, quality control personnel, dedicated workmen & the latest precision European machinery. Our fabrication facilities are capable of manufacturing high pressure vessels & are equipped with certified x-ray qualified welders. For hard facing & critical wear & tear parts our highly trained TIG/MIG welders take over. Crucial to every part of the process, our quality department checks the project at every stage ensuring our clients always get superior quality products. Our equipment has a reputation of being robust in construction, superior in quality, versatile in nature & operationally profitable. Also, our vastly experienced personnel provide training to customers; operating staff.

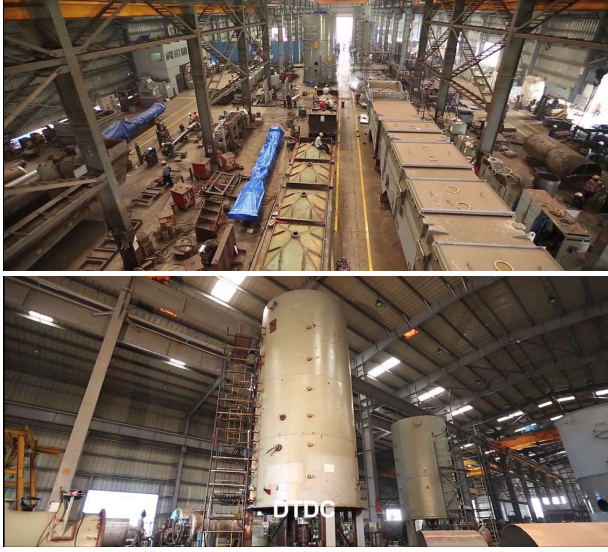



**Manufacturing Infrastructure**



Factory Details	Mira Road Unit No.1	Manor, Palghar Unit No.2
Land (Sq. Ft)	45,000	2,00,000
Covered Area (Sq. Ft)	40,000	77,000
Building (Sq. Ft)	6,000	2,270
Fabrication Bay (Sq. Ft)	30,000	56,000
Machine shop (Sq. Ft)	6,500	12,000
Crane capacity	20 ton*4 and 5 ton*2	30 ton*2 and 20 ton*5
Stores (Sq. Ft)	7,000	9,000

### Kumar Infrastructure





DTDC



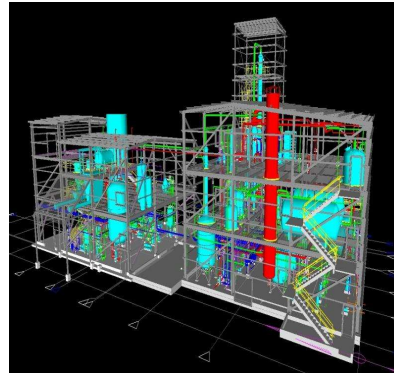
### Kumar Strengths

- Process Design
- Detailed Engineering
- Equipment Manufacturing
- QA/QC Approval
- Erection
- Trial Run & Commissioning
- Performance Optimization
- Operation & Maintenance Training



## Kumar Strengths - Engineering Tools

- AutoCad latest version
- CADWorx P&ID
- CADWorx Pipe
- Navisworks
- ChemCAD
- HTRI
- Compress
- Solid Works
- FEA



## Kumar Services Offered

### ❑ Technology Identification:

Identify the appropriate technology and selection of equipment with modern technology in various processes.

### ❑ Project Execution:

Experienced engineers coordinate individual project from start to finish.

Well qualified mechanical/chemical engineers having vast experience for project execution.

### ❑ Engineering

Equipment and Foundation layout P&ID's, utility consumption Parameters, 3D Modeling, structure design, utilities and complete design integration of complex.

Have designed plants as per European, American, Australian, NZ standards, including FEA analysis, Stress analysis and Structural load designing.



## Kumar Services Offered

### ❑ Installation:

Well trained Installation team in all aspects such as shifting of equipment, foundation layouts, piping, instrumentation, cabling and Insulation. Kumar has installed plants all over the world.

### ❑ Commissioning

Our commissioning team provides dry run and product trials with full performance before handover achieving all utilities and consumption as per our agreement.

### ❑ After Sales:

Our services include trouble shooting, monitor performance, advice on possible expansion plans and improvements.

Kumar believes in 24x7 after sales services.



## Turnkey Solutions

- ❑ Installation of the plant including tools and tackles, workshop equipments.
- ❑ Pre fab structure for plant buildings.
- ❑ Cooling tower, pump with water distribution system.
- ❑ Steam boiler with steam distribution network and water treatment plant.
- ❑ Air compressor and distribution network.
- ❑ Storage tanks design & supply with instrumentation & automation.
- ❑ Laboratory equipments & instruments.
- ❑ Grain unloading, precleaning & storage Silos.



## Crushing Technology for Extruded Soybean

### **Kumar Soybean Seed Processing Technology**

#### **Mechanical Extraction of Soybean seed**

Full Press (Single Pressing)

By Extrusion Process

By cooking Process

#### **Solvent Extraction**

Prepress Cake Solvent Extraction

Direct Soybean seed Extraction after Preparation



## Crushing Technology for Extruded Soybean

### **Why Extruded Full Fat Soybeans?**

- Cost of production is lower than solvent extracted soybean meal
- The oil in extruded full fat soybeans is stable and highly digestible
- Extrusion increases amino acid digestibility.
- Easier and cheaper method to add oil uniformly in the feed
- Frees the oil by rupturing plant cell walls
- Reducing bitter flavors





## Crushing Technology for Extruded Soybean

### Dry Extruders Coupled with Expellers for Mechanical Oil Extraction

When coarsely ground soybeans were processed in a dry extruder, the material discharged was in a semi-fluid state when the extrusion temperature was about 140- 150 °C.

Upon cooling, the oil is absorbed back into the protein matrix and the material becomes a dry and mealy mass. In order to extract the oil, the extrudate must be pressed immediately after extruding. There is progressive loss of oil extraction efficiency upon cooling of the extrudate.

71.8% extraction of oil in a single pass through the extruder and screw press system. The residual oil content in resulting press cake was 6–8%.

The trypsin inhibitor activity in raw soybeans was reduced by 91% due to the heat exposure during the extruding and screw-pressing

The protein dispersibility index (PDI) was reduced from 88% in the raw material to 13% in the flour. The flour contained 6-8% residual oil and 50% protein on a dry matter basis (0% moisture). The sensory quality of the flour was excellent, with bland flavor and light color.



## Crushing Technology for Extruded Soybean

### Objectives of Extruded Soybean

- Soybeans are one of the most nutritious foods that exist today because of the essential nutrients they contain (36% protein and 18% oil as well as all essential amino acids). Even though they are a great source of amino acids, they cannot be consumed raw. The reason for that is because they also consist of anti-nutritional factors such as trypsin inhibitors, urease and lectins that adversely affect digestive efficiency.
- Soybean meal represents more than 50% of the total oilseed meal production. Raw soybeans cannot be used as such for animal feed or human food, because they contain several different antinutritional factors.

These factors are

- a) Trypsin and chymotrypsin inhibitors;
- b) Phytohemagglutinins (Lectins);
- c) Urease;
- d) Allergenic factors; and
- e) Lipases and Lipoxygenases.

- These factors affect the digestion of soybeans in the stomach. All can be deactivated, modified or reduced through proper heat treatment to minimize or eliminate their adverse effect. Since all these inhibitors are proteins, caution should be taken to assure that no destruction of the oilseed protein occurs. This can be accomplished only through optimum processing and good quality control measures.



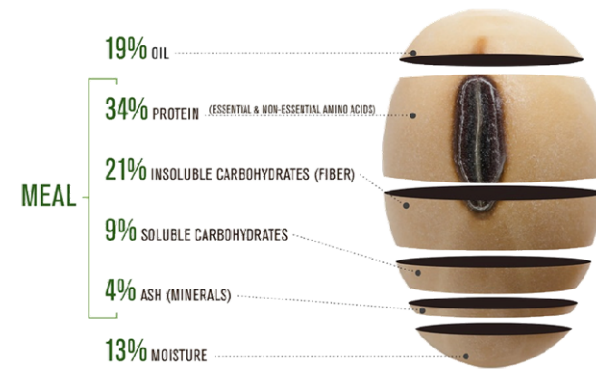
## Crushing Technology for Extruded Soybean

### Extruded Soybean Meal

- It is the meal product resulting from extrusion by friction heat and/or steam of whole soybeans without removing any of the component parts. It must be sold according to its crude protein, fat and fiber content.
- Extruded/expelled soybean meal (ESBM) is produced by mechanical friction creating a high temperature for a short time period. The temperature and the time spent at a given temperature directly affects the quality and nutritional value of the product.
- The extruded oil that is produced has unique characteristics in terms of stability and low levels of phosphatides, unsaponifiable matter, peroxide value and free fatty acids.



## Crushing Technology for Extruded Soybean



Typical Soybean Seed Parameters



## Crushing Technology for Extruded Soybean

### Factors Affecting Soybean Composition

- Plant
- Soil fertilization
- Nitrogen fixation
- Soil trace minerals
- Locality climate & environment
- Water
- Agronomic practices



## Crushing Technology for Extruded Soybean

### Mechanical Extraction of Extruded Soybean

Typical Specification – Feed

Soybean Seed

- Oil Content : 19-20%
- Protein : 36-38%
- Process : FULL PRESS

- FULL PRESS (Single Pressing):
  - Residual Oil in cake : 6-8 %
  - Protein : 42-44%
  - Moisture: 9-10%



## Crushing Technology for Extruded Soybean

### Cooking Temperature

- Dry Extrusion : 140 – 160 Deg.C (Friction)
- Wet Extrusion : 135 – 140 Deg.C (Steam, less friction)
- Expander : 100 – 140 Deg.C (Steam, less friction)
- Toasting, SEP : 100 – 105 Deg.C



## Performance of Extruding-Expelling Systems

### Extruding-Expelling Soybeans and Cottonseed Oil

Protein in meal	Oil in seed (%)	Protein in seed (%)	extraction efficiency (%)	Extruding temperature (°C)	Oil in meal (%)
Oilseed (%)	(%)	(%)	(%)	(°C)	(%)
Soybean 42–46	18–22	34–38	65–67	140–150	6–8
Cottonseed 26–30	20–22	20–22	65–70	110–120	6–8

All values used for oil content are expressed in average ranges. Actual content varies due to differences in varieties and growing conditions. Operator management also influences the quality of the end product



## Crushing Technology for Extruded Soybean

### Extruded Soybean Meal



I.



II.



III.



## Crushing Technology for Extruded Soybean

### Use of Extruded Soybean Meal

- Soybean meal is commonly used in swine diets worldwide.
- Soybean meal products contain high concentrations of protein, an excellent balance of amino acids and high-energy content, making them an excellent source of protein.
- Soybean meal contains elevated levels of lysine and tryptophan, amino acids that are deficient in common energy sources such as corn.
- Using soybean meal, it is possible to simplify diets and not require other supplemental protein sources.
- Soybean meal is widely used as a protein supplement in livestock diets.
- Dry extruded soybean meal (DESB) is a soybean meal product that has a higher fat content than regular solvent-extracted soybean meal. This product is currently available to swine producers in Manitoba.



### Crushing Technology for Extruded Soybean

#### Extruded Soybean Meal for Animals



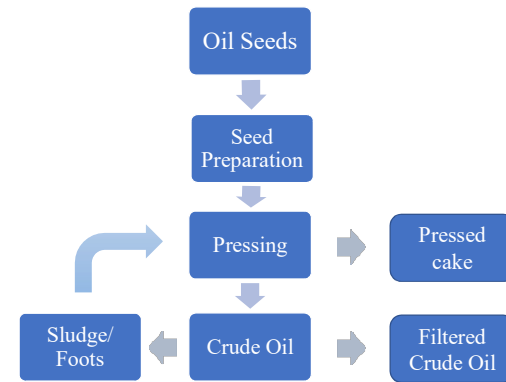
I.

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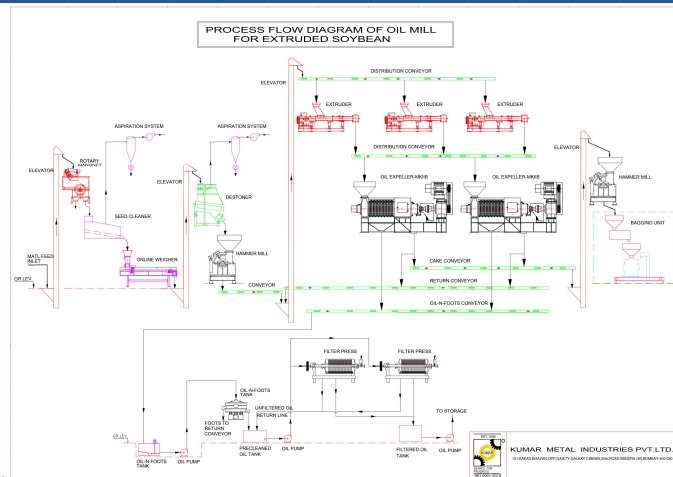
### Crushing Technology for Extruded Soybean



Oil Mill Process Flow Diagram



### Crushing Technology for Extruded Soybean



Process Flow Diagram of Crushing of Extruded Soybean Seed



### Crushing Technology for Extruded Soybean

#### Kumar Expellers

- New Super Press Series
- New Oil N Oil Series
- Xpress Series
- PK Series



### Crushing Technology for Extruded Soybean

Mid range expellers with double/Triple chambers designed to meet the needs of medium sized mechanical Extraction Plants



Kumar New Super Press Series



### Crushing Technology for Extruded Soybean

#### Kumar New Super Press Series

TECHNICAL DATA		FULL PRESS		PRE-PRESS	
Type		NSP IIB	NSP IIIICLD	NSP IIB	NSP IIIICLD
Capacity	MT /24h	22-25*	45-55	30-35	60-70
Residual oil in cake	%	7-10	7-10	16-19	16-19
Rated Power for Main motor	HP	75	150/175	75	150/175
Rated Power for Oil N Foots Conveyor	HP	1	1	0.5	0.5
Chamber size	Feed	Φ279.4 x 939.8 L	Φ330 x 939.8 L	Φ279.4 x 939.8 L	Φ330 x 939.8 L
	Middle	X	Φ279.4 x 584.2 L	X	Φ279.4 x 584.2 L
	Discharge	Φ209.5 x 863.6 L	Φ254 x 863.6 L	Φ209.5 x 863.6 L	Φ254 x 863.6 L
Approx.Wt.	MT	7.5	10	7.5	10





### Crushing Technology for Extruded Soybean

Small to Mid range Single chamber expellers designed to meet the needs of small and medium sized mechanical Extraction Plants



**Kumar New Oil N Oil Series**



### Crushing Technology for Extruded Soybean

TECHNICAL DATA	UNIT	FULL PRESS		PRE PRESS
		NMK IVC	NMK VII	NMK VII
Type				
Capacity	MT /24h	10-12	25-30	30-40
Residual oil in cake	%	7-9	7-9	16-19
Rated Power for Main motor	HP	40	60/75	60/75
Rated Power for Oil N Fouts Conveyor	HP	X	0.5	0.5
Chamber size (Dia. X Length)	mm.	178/222x 1117.6 L	Φ255/230 X 1565 L	Φ255/230 X 1565 L

**Kumar New Oil N Oil Series**



## Kumar X'Press Series

Largest of all series consisting of Steel cast Double chamber expellers with Horizontal and Vertical feeders  
 Designed for Prepress of Palm Kernel



## Kumar X'Press Series

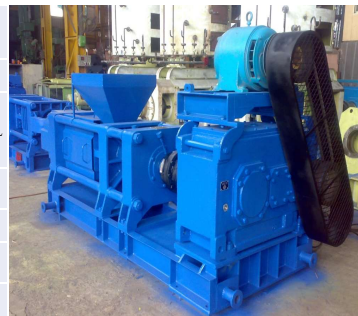
TECHNICAL DATA		FULL PRESS		PRE-PRESS		
Type		XP-200	XP-250	XP-200	XP-250	
Capacity	MT/24h	75-130*	90-150*	100-180*	120-200*	
Residual oil in cake	%	7-10	7-10	16-20	16-20	
Rated Power for Main motor	HP	215 / 335	250 / 335	215 / 335	250 / 335	
Rated Power for Oil N Foots Conveyor	HP	1	1	1	1	
Rated Power for Horizontal Feeder	HP	3	3	3	3	
Rated Power for Vertical Feeder	HP	7.5	7.5	7.5	7.5	
Chamber size	Feed	mm .	Φ 300 x 1300L	Φ315 x 1300 L	Φ 300 x 1300L	Φ315 x 1300 L
	Disch		Φ275 x 1350 L	Φ290x 1350 L	Φ275 x 1350 L	Φ290x 1350 L
Approx.Wt.	MT	17.5	18	17.5	18	



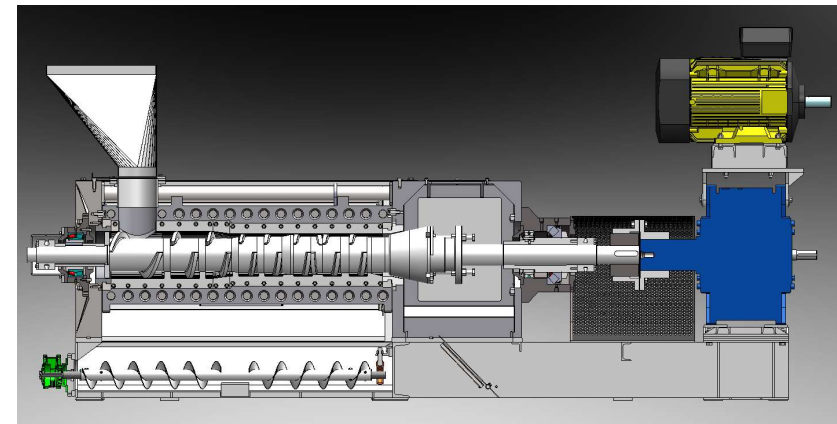
### Kumar Expellers – PK Series

Specially designed and manufactured for extraction of Palm Kernel consisting of Fabricated single chamber expellers

TECHNICAL DATA	UNIT	FIRST PRESS		SECOND PRESS	
		PK-15	PK-25	PK-15	PK-25
Type					
Chamber size (Dia X Length)	mm.	Φ178 x 640 L	Φ209 x 640 L	Φ178 x 640 L	Φ209 x 640 L
Capacity	MT/24 h	12/15	22/25	8/10	14/16
Residual oil in cake	%	18-20	18-20	8-10	8-10
Required power rating	Kw/HP	37/50	55/75	37/50	55/75
Approx.Wt.	MT	4.5	4.8	4.5	4.8



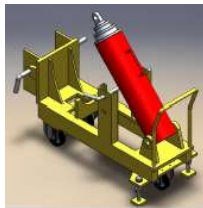
### Kumar PK Series



## Crushing Technology for Extruded Soybean

### Salient Features - Kumar Expellers

- High efficiency External Gear Box.
- Sturdy Construction, low Investment and easy installation.
- Maximum Oil yield at low operating costs.
- Suitable to crush all type of edible and non-edible oil seeds.
- Easy and time saving main worm shaft removal without disturbing the gear box assembly.
- Vertical split hinged main cages provided with cage lifting for safe, quick and effortless maintenance.
- Maximum oil yield at low operating cost due to our chamber, cage bars and shims design
- Convenient height of worm shaft for easy maintenance.
- Easy worm shaft withdrawal without disturbing the expeller drive
- Hydraulic Chamber opening and closing reduce the manual effort and save time of the operator during maintenance.



## Crushing Technology for Extruded Soybean

### Salient Features – Kumar Expellers

- We use special electrodes for hard facing which makes the life go on 3-4 times the normal electrode. This is a major recurring cost which goes down making it a faster return on investment.
- Hydraulic cone adjustment system – adjustment can be done while the expeller is in running condition, cake thickness is adjusted by control valves. It saves time as in manual operation you have to stop the expeller various time to adjust cone.
- Special designed locking type clamping bars and bolts to enable easy tightening & removal of the cage.
- Fully enclosed cage with a built in screw conveyor at the base for conveying oil and foots which keeps the shop floor neat and clean.
- Steel cast hobbing cut helical gears. Induction hardened, completely assembled on a single piece hollow driving sleeve with heavy duty roller and taper roller bearing to acquire perfect alignment and friction free for energy saving.
- Multistage vertical stack cooker for proper conditioning of the seeds.
- All the bearings are SKF/ZKL and are lubricated with the help of a special motorized pump to increase bearing life.



**Crushing Technology for Extruded Soybean**

SCREW CONVEYOR (U TROUGH/ PIPE TROUGH)      BUCKET ELEVATOR      CHAIN CONVEYOR

**Kumar Material Handling Equipment**

**Crushing Technology for Extruded Soybean**

**Magnetic Separator**

The Rotary Magnetic Drum Separator provides automatic separation of ferrous and non-ferrous material

**Seed Cleaner**

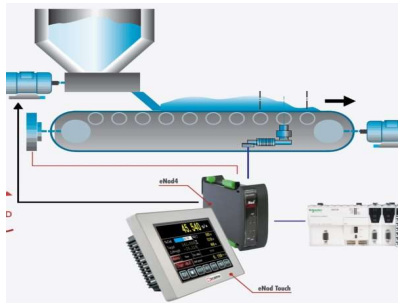
Seeds are properly cleaned into seed cleaner to remove unwanted material like dust, leafs, steins, etc. Then the seeds are subjected to Destoner to remove various sizes of stones / sand. This removal of unwanted material reduces the down time & increases the life of machines.

**Kumar Equipments used in Extruded Soybean process**

### Crushing Technology for Extruded Soybean

**Online Weighing**

Online Weighing machine is used to measure the feed seed quantity in the plant by the help of load cells.



**De-stoner**

Vibratory type operating on vacuum principle. Steel box frame with sieve slope adjustment. Sieve box supported on rubber blocks with durable wooden sieve frames, covered with steel screens, aluminium baffles and cleaners. Complete with inspection windows and adjustable stone separation device. Includes cyclone, air lock and air fan



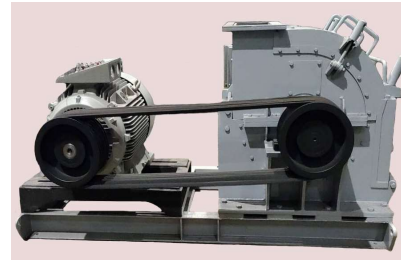
Kumar Equipments used in Extruded Soybean process



### Crushing Technology for Extruded Soybean

**Hammer Mill**

Hammer Mill is mainly used to disintegrate the seed to desired size to have the proper Expelling. The Hammers (Beaters) are rectangular for efficient grinding & are made from hardened alloy steel.



**Extruder**

Extruder is used for conditioning of seed by friction to increase the outlet temperature of cracked seed by 140-150 deg c to reduce urease activity.



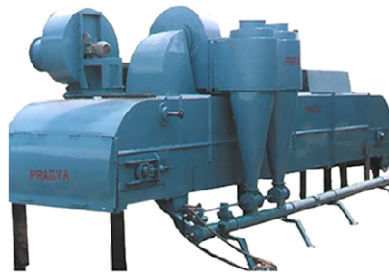
Kumar Equipments used in Extruded Soybean process



## Crushing Technology for Extruded Soybean

### Cake Cooler

Modular horizontal type single/Double pass chain conveyor type, enclosed unit fitted with blowers, radiators and gear box motors. Drive module fitted with main conveyor sprockets, shafts, pedestal bearing drive gear box, drive chain and sprocket rotary feed unit. Drying module contains steam radiator, FD Blower, ID fan blower. Cooling module contains blower, ID fan, Discharge module fitted with main conveyor sprockets shaft take up type pedestal bearing, discharge hopper, fins collecting screw and complete with drive unit



Kumar Equipments used in Extruded Soybean process



## Crushing Technology for Extruded Soybean

### Weighing, Bagging & Stitching Machine with Slat Conveyor

- Consisting of Feed hopper, pneumatically operated load cell type bagging, weighing system and discharge hopper for weighed materials, slat conveyor, stitching machine and pneumatically controlled system.
- Feed hopper & discharge hopper is made up of Mild steel plate
- Stitching machine is used for stitching the bags.
- Each bagging machine will be suitable 50 - 60 Kg bag each with accuracy of +/-100 Grams or better on average of 20 consecutive weighing.



Kumar Equipments used in Extruded Soybean process



## Crushing Technology for Extruded Soybean

### Vibro-Separator

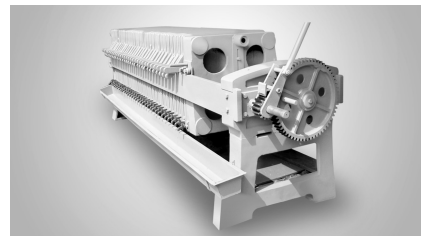
The Vibro Separator is a separating machine of coarse sludge from crude oil, which includes a vertical type special motor to facilitate three dimensional composed circular and elliptic motions in horizontal, vertical & inclinational faces. The vibro separator achieves superior performance as the feed (Crude Oil) is dispersed from the centre equally; hence all parts of screen cloth are fully utilized.



### Filter Press

Filter press is used to separate the Fine sludge from the feed oil by using Filter cloth.

Plate type CI filter press complete with ratchet tightening arrangement, filter cloth set, cocks, pressure gauge and safety valve and pump with motor



**Kumar Equipments used in Extruded Soybean process**



## Kumar Solvent Extraction Plant

### KUMAR SOLVENT EXTRACTION PLANTS FOR

Prepress / Full-press Cake like Palm Kernel, Shea, Sunflower, Groundnut, Cottonseed, Rape seed, Copra, Castor Seed, Niger,

Solvent Extraction Plants With Preparatory for Various Feeds like Soybean, Cottonseed, Rice Bran, Salnut, Pk, etc.

Specialty Solvent Extraction Plant For Essential Oils , Pine chips , polymers





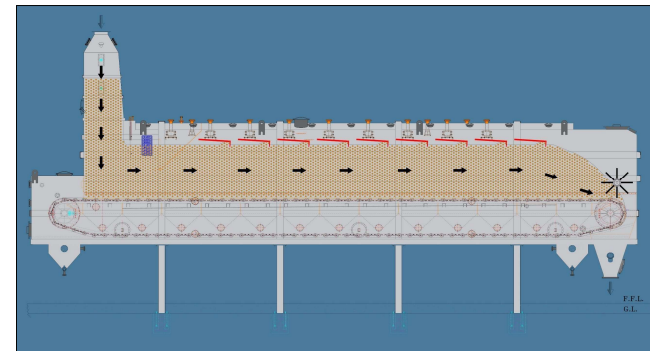
## Kumar Solvent Extraction Plant

### General Steps

- Preparatory
- Solvent Extraction
  - Extraction
  - De-solventisation
  - Distillation
  - Recuperation
- Meal Cooling & DOC Bagging



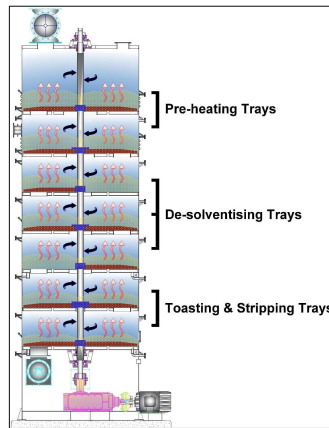
## Typical Kumar Extractor



- Specially designed perforated SS wire mesh & cadre frame provided below the bed for proper solvent drainage and to reduce chocking there by improving extraction efficiency
- Extractor with single piece miscella hopper having no weld joints
- Extractor is delivered after successful no load trial runs at shops



### Typical Kumar De-solventizer-Toaster



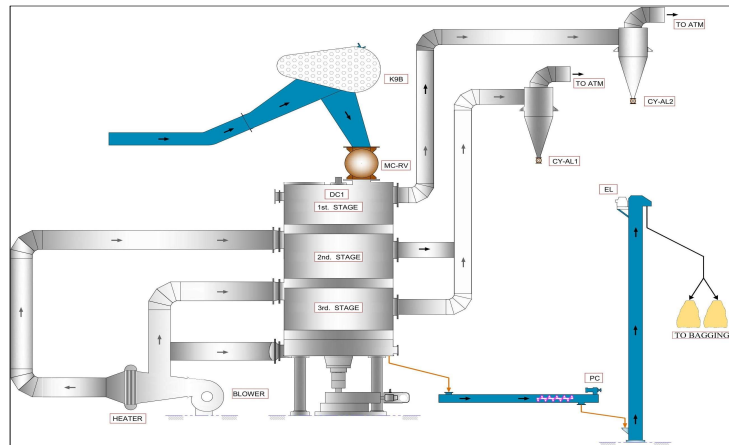
- DT is specially designed with uniform counter flow system of steam distribution in the trays during de solvation – toasting & vapor separation.
- Specially designed sparge steam tray to facilitate better de solvation and uniform moisture addition for better toasting of meal



### Kumar Extractor



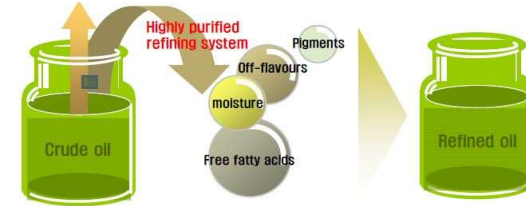
Process Flow Diagram for Kumar Meal Conditioning Section



Kumar Refining Process of Crude Oils

Crude Oil contents

- Phosphatides
- Wax
- Free Fatty Acid
- Moisture
- Odoriferous Material
- Pigments



## Kumar Refining Process of Crude Oils

### Key Process:

Water Degumming & Neutralisation

Pre-treatment & Bleaching

De-acidification / Deodorizing



## Kumar Refining Process of Crude Palm Oil / Palm Kernel Oil

### Additional Process:

Dry Fractionation

Multiple Fractionation



## Kumar Refining Process

Refinery involves

Degumming or acid conditioning to remove phosphate

Neutralization or DE acidification to remove free fatty acids by treatment with lye(called alkali neutralization or chemical refining) or by distillation (called Physical refining)

Bleaching to remove pigment by adsorption treatment

Deodorizing and stripping In vacuum condition to remove odors

DE-waxing, hydrogenation, fractionation.



## Kumar Water Degumming & Neutralisation Section

Crude oil as received from extraction plant contain some non-triglyceride component which must be removed eg. Phosphatides, free fatty acids, pigment odor and flavors waxes as well as heavy metal, pesticides etc

The Edible Oil Refining process depending on types of Phosphatides either water degumming, Acid Degumming, or Super degumming is carried out so as to yield Phosphorous contents of less than 10ppm.

Degumming is the first stage in refining process. It is used to separate gums, phospholipids, protein etc that are insoluble in oil when hydrated

### **Aim of degumming**

The emulsification action of phospholipids increases oil losses during alkali refining

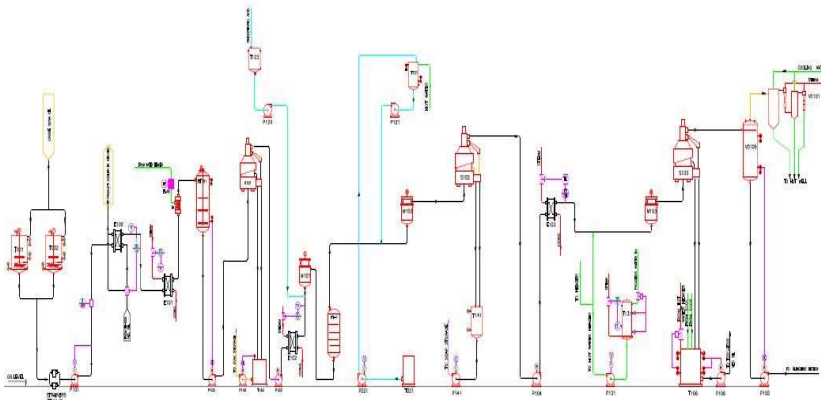
Gums lead brown discoloration of oil after heating during deodorization.

Salts may be formed with copper magnesium calcium and iron accelerating oxidative degradation of oil

Certain phosphatides such as lecithin, find widespread industrial application



### Kumar Water Degumming & Neutralisation Section



### Kumar Pre-treatment & Bleaching Section

#### PURPOSE:

To remove the contaminants from crude oil prior to Deodorization

- Insoluble solids (Meal)
- Phospholipids (Gums)
- Oxidative materials (Metal Ions)
- Metals & pr-oxidants (Cu, Ca, Fe, Mg and P)
- Color bodies (Chlorophyll & Carotenes)



## Kumar Pre-treatment & Bleaching Section

### PURPOSE:

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- Color bodies (Chlorophyll & Carotenes)



## Operating Conditions Bleaching Section

### Operating conditions depend on bleaching clay

Condition	Range	Typical
Temperature	Up to 125°C/260°F	85-110°C 185-230°F
Time	30-40 min	30-40 min
Vacuum	50-70 mmHg	50-70 mmHg
Moisture	0.1-0.5%	0.2-0.3%



### Kumar Bleaching Section



#### Bleacher Vessel

The bleacher vessel is vacuum vessel with dished heads, multiple agitated compartments, agitator with mechanical seal, sight glasses and manways. It operates under vacuum to ensure complete moisture / air removal. The dry oil and earth mixture is discharged by the filter charge pumps to one of the bleaching filters .



### Kumar Pre-treatment & Bleaching



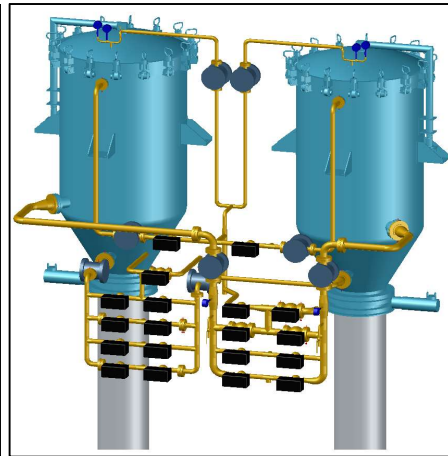
#### Salient Features

- Compact Design - A Single vessel for bleaching earth slurry preparation & Bleaching
- Better contact between oil & bleaching earth since bleacher is equipped with mechanical agitation & sparging steam
- Maximum Oil recovery by steam blowing results in lower retention of oil in spent earth
- Low consumption of bleaching earth
- Lower consumption of utilities
- Ensure accurate dosage of bleaching earth controlled by PLC
- No carryover of bleaching earth to the vacuum system
- Efficient Automated filter operation



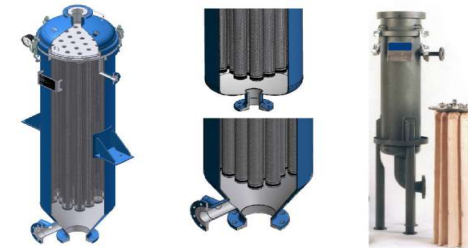


### Pressure Leaf Filters



### Recent Trends in Bleaching

- Kumar Steam Agitated Bleacher
- Improved bleaching clay activity while maintaining fast filtration
- Inline color and turbidity measurement
- Pulse tube filter replacing bag filters as the polish filter (most useful for stock changes)



## Kumar De-acidification / Deodorizing:

### PURPOSE

Improve odor, flavor, colour and stability of oils and fats by removing or inactivating:

Material causing unpleasant odors or flavors (FFA, aldehydes & ketones)

Unsaponifiables (tocopherol and sterols)

Oxidative materials (peroxides)

Colour bodies (carotenoids)

Toxic substances (pesticides & herbicides)



## Types of Deodorizers

- Continuous Deodorization
- Tray Type
- Packed Column (PC)



### Typical Deodorizing Feedstock Specifications

Free Fatty Acid (FFA): 0.07% - 5%  
 - 0.07% to 0.1% for neutralized oils and fats  
 - 3% to 5% for palm oil and edible fats

Phosphatides: 2-10 ppm P

Moisture:  $\leq 0.1\%$

Iron (Fe):  $\leq 0.2$  ppm

Unsaponifiables: 1.0%

Soap: zero

Impurities: zero



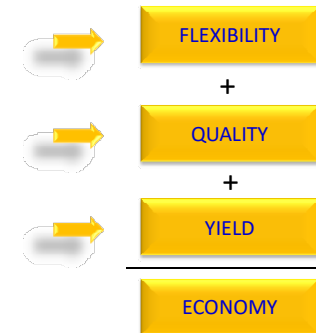
### Kumar Continuous Deodorizing System

**Benefits:**

Designed for:  
 Deacidification (physical refining)  
 Deodorizing

Low Trans  
 Preserve oil quality  
 Maximum protection from air

Low steam consumption  
 Low energy consumption



## Kumar Deodorizer



- No stagnant zone.
  - Ensures large surface area provided by structured packing to stripped of the FFA (free fatty acid)
  - Ensures an extremely high steam to oil interfacial surface.
  - Highly efficient mammoth pump for sparging the steam to ensure the intensive agitation.
  - Low pressure drops.
  - Robust construction.
  - Easy maintenance.
  - Low stripping steam required.
  - Optimized retention time reduces low trans fatty acid formations.
  - Minimum carry over of the fatty acid by specially designed fatty acid scrubber equipped with structured packing & demister pad.
  - Heating & cooling under vacuum
- Specially designed automation system for risk free & easy operation to avoid human error.



## Kumar Deodorizer

### Automation System for Deodorization Section

Kumar metal provides dedicated PLC based plant control automation system. Allow the plant operator to monitor all the process activity like plant start up, shut down & process parameters from one centralized location.

Easy system helps the operator to understand how to proceed with the operation sequence by easy graphical presentation.

Risk free operation with minimum human mistakes.

Data locking of all the process parameters.

History data base to analyze for all process parameters and generated the report which is undeniable witness of complete activity of process.



## Kumar De-acidification / Deodorizing Plant

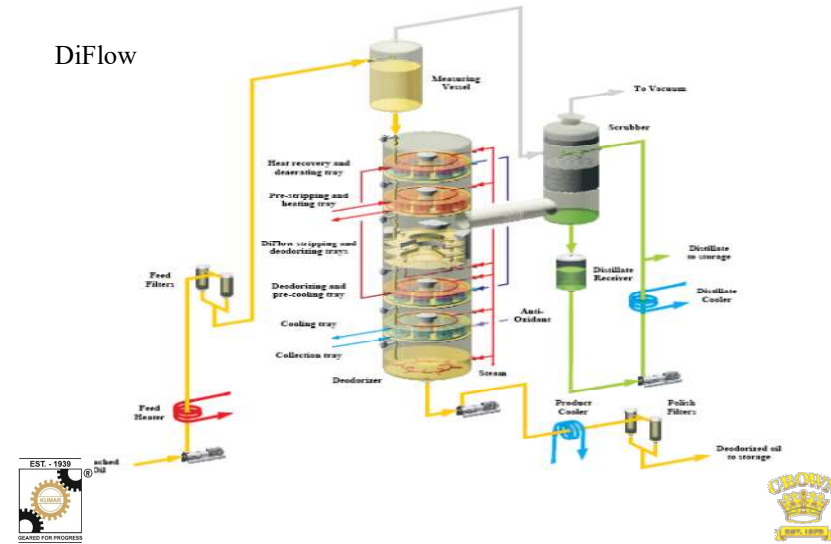
### Salient Features

- Well designed structured packing in the Deaerator,
- Low steam requirements - Optimised live steam injection and full vacuum to ensure excellent deaeration of oil.
- Minimised polymerization in heat exchangers.
- High heat recovery in Deodorizer having efficient Inbuilt Economizer - Maximum heat is recovered from deodorized oil to ensure proper oil temperature for storage for optimum shelf life.
- Efficient deodorizing of oil, Low cross-contamination - Kumar system is designed for optimum deodorization temperature and high retention time to ensure enhanced shelf life of refined oil having negligible Trans Fatty Acids.
- Low oil carryover with fatty acid resulting in lower deodorizing process loss.
- Efficient designed vacuum system for low motive steam consumption.
- Well designed liquid distributor in vapor scrubber to ensure optimum condensation of free fatty acid vapours.



## Kumar Crown Semi-Continuous Deodorizing System

### DiFlow



## Kumar Crown Semi-Continuous Deodorizing System

### Salient Features

Designed for:

- Multiple products, frequent stock changes
- Deacidification (physical refining)
- Deodorizing
  
- Low comingling
- High deodorizing efficiency
- Preserve oil quality
  
- Low steam consumption
- Low energy consumption



## Recent Trends in Deodorizing

Two stage (dual) scrubbers for concentrating tocopherol distillate for soya oil

Concentrating Palm Fatty Acid Distillate (PFAD) FFA to 93%. The increase in FFA of PFAD will increase the yield of RBD Palm Oil. However it is Feasible for 400TPD capacity and above due to increase in capex cost.

Increased use of chilled loop and ice condensing vacuum systems

Semi continuous di flow deodorizing for multiple stock changeovers



### Vacuum System Considerations

1. 4 stage direct contact (barometric) with dirty cooling tower
2. 4 stage direct contact with closed loop
3. 4 stage indirect contact (surface condenser)
4. 3 or 4 stage direct contact with chilled loop
5. 4 stage direct or indirect contact with ice condensing



### Vacuum System Cost Comparison

Cost	Surface Condenser	Closed Loop	Chilled Loop	Ice Condensing
Equipment	1	1.1	1.25	3
Electrical	1	4	22	16
Cooling Water	1	0.9	0.5	0.1
Total Operating	1	0.9	0.5	0.2



## Kumar Dry Fractionation Technology

A process to separate vegetable oils such as palm oil into two fractions, Olein and Stearin, by the crystallization properties of the oils..

### Crystallization Section

Preheating RBD palm oil

Cooling in a controlled environment to form crystals using PLC or programmable controllers.

### Filtration Section

An automated membrane filter press to separate the stearin crystals from the liquid olein.

Olein yield is maximized by squeezing the stearin cake through inflation of the membrane with air or liquid.



## Kumar Dry Fractionation Technology





## Kumar Dry Fractionation Technology

Separating high-melting fractions (stearin) from low-melting fractions (olein) by cooling in a controlled process is called fractionation. One of the key factors determining the success of the fractionation process is the efficiency of separation. Fractionation is designed to separate various fractions based on differences in crystallizing temperatures.



## Kumar Plant & Process Automation Services

Automation is the use of control systems and information technologies for plant operation by reducing human intervention

General plant operation modes:

- Manual
- Semi automatic
- Automatic

•Benefits :

- Increased labor productivity and reduction in labor cost
- Mitigates the effects of labor shortages
- Reduction/Elimination of routine manual/clerical tasks
- Improved Human and Plant safety
- Better Process Control and Improves product quality
- Reduction in manufacturing lead time

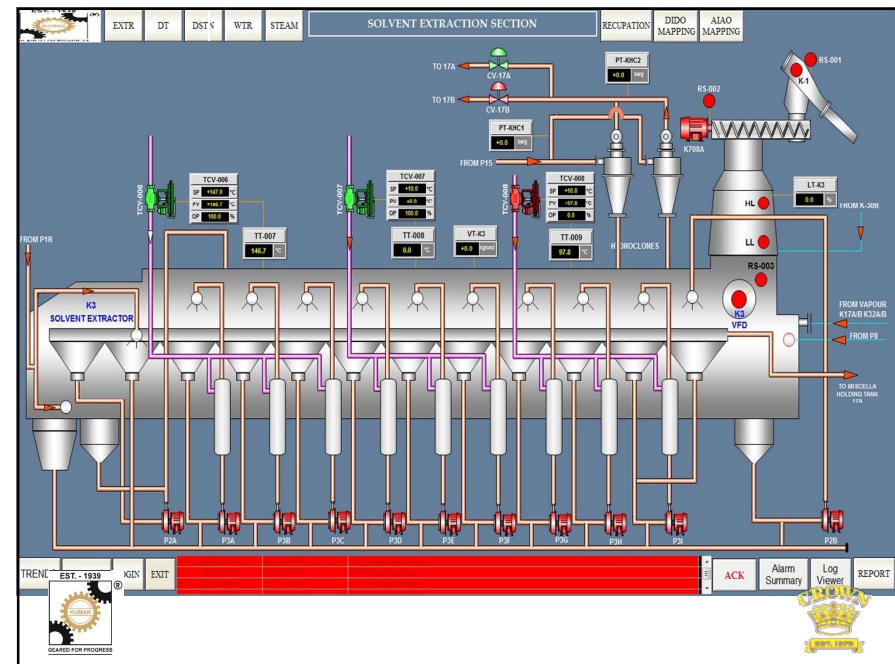


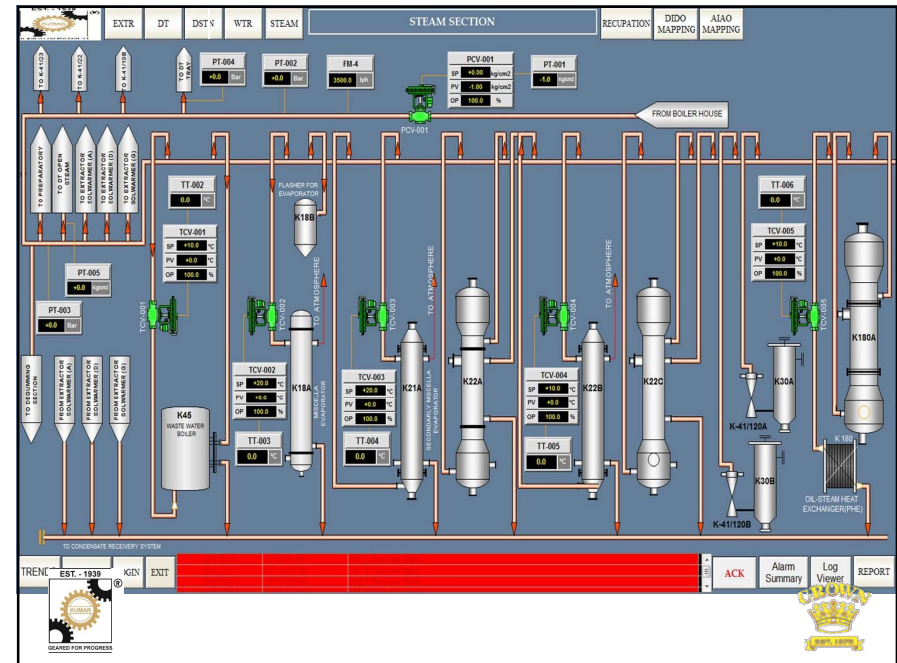
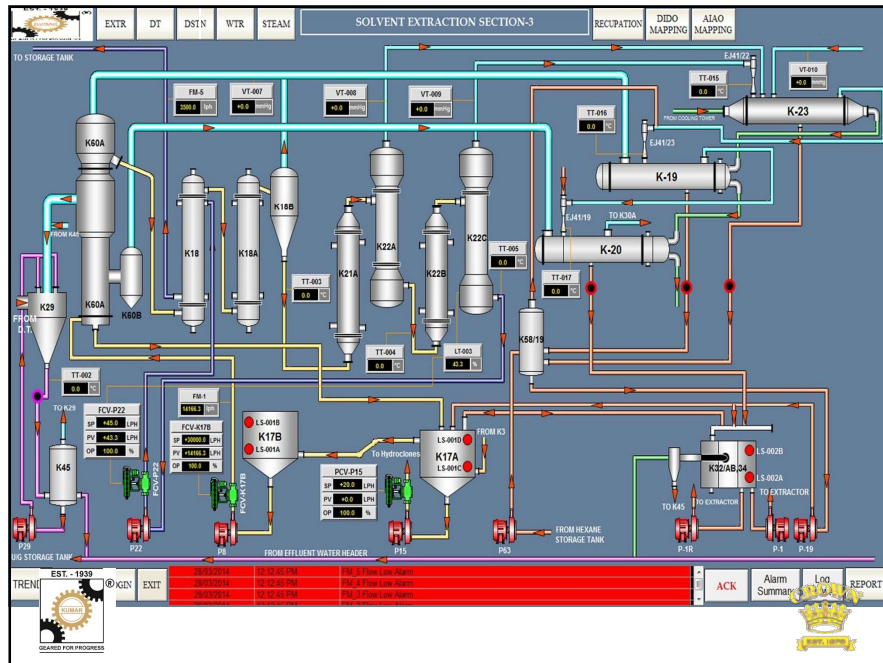
## Kumar Plant & Process Automation Services

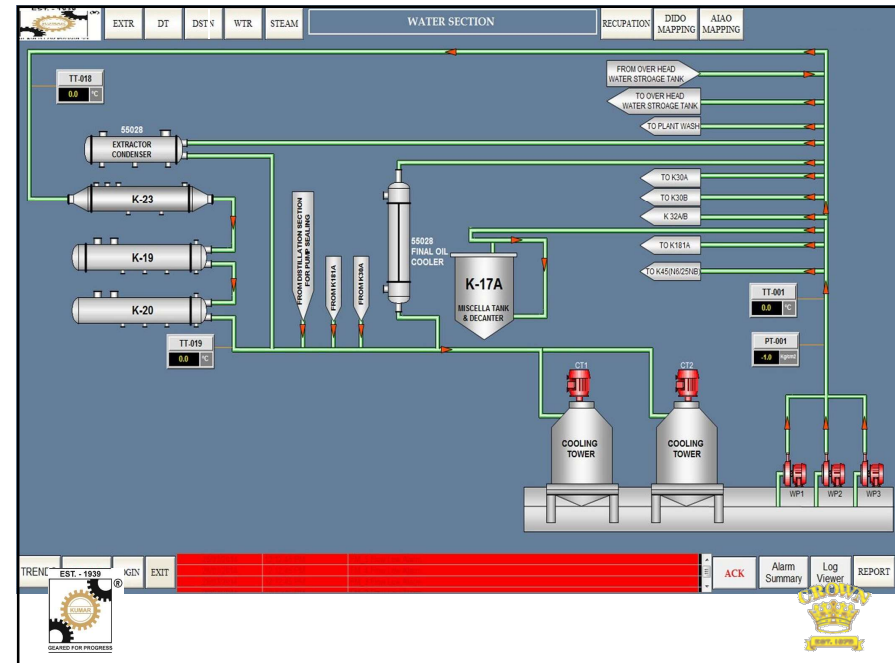
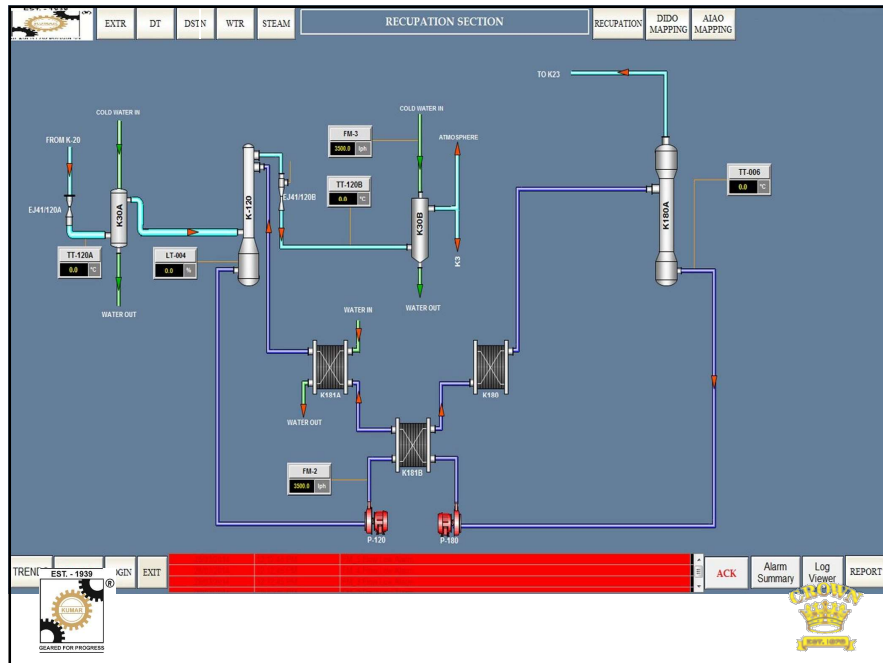
KUMAR Automation is with the state of the art instrumentation and Software for complete processing control from the Desk.

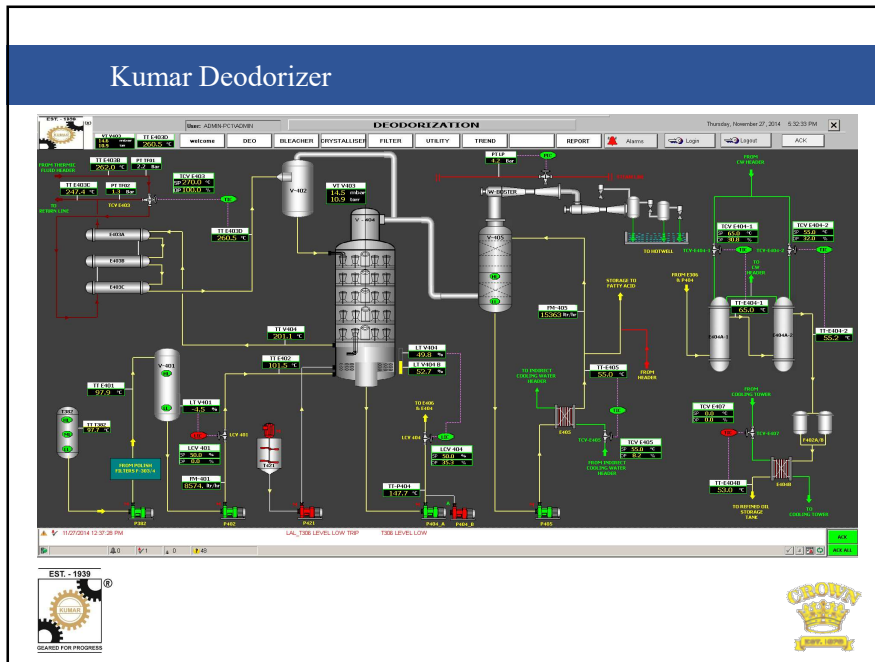
It can offer Off Site control trouble shooting through our Cloud based online system. The refinery can be operated from a remote control through internet and also rectification of the process can be carried out from the remote location.

Process automation ensures better control of critical process parameters like steam, water and all other utilities and chemicals thus improving final oil quality and reducing human error. Through our automation you can control critical operation like the switching over of the pressure leaf filters as well, maintaining and sealing Vacuum in the deodorizer and also getting complete accountability of raw material coming into the plant and finished product going out, through our totalizer and mass flow meters.











### Highlights of Kumar Plants

- Optimum energy and utility consumption per MT of feed
- Solvent Extraction Plants are designed confirming NFPA36
- Well designed and manufactured equipment as per applicable design code like ASME section VIII Div. 1 with high level of quality
- All heat exchanger, coolers, condensers as per ASME section VIII Div 1, TEMA & Sound Engineering Practice (SEP) standards & Third party Inspections
- Electrical motors, cable, control panels are confirming to IEC standards
- Kumar systems are in accordance to Health and safety requirements as per international norms

## Highlights of Kumar Plants

- Project bought outs (like Motors, Gear Box, Pumps, Vacuum systems, Instruments, etc.) from reputed multinational companies like Siemens, E+H, KSB, Mazda (Croll Reynolds), Buhler, etc.
- Technical construction file of equipment comprising of QAP, Material Test Certificates, stage wise Inspection report, Final test reports, etc. is provided along with equipment supply.
- Turnkey Projects are executed by competent & experienced project team with proper monitoring of quality & schedule.
- Pre-Commissioning & product trials are carried out by experienced commissioning engineers to ensure proper operation to achieve desired product quality & rated capacity.



**THANK YOU**

**KUMAR METAL INDUSTRIES PVT. LTD.**  
**In Joint Venture with**  
**CROWN IRON WORKS, USA.**



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