INTRODUCTION TO SUPERCRITICAL CO2 EXTRACION SYSTEM

Presented By Ajit S Burangey

CHEMTRON SCIENCE LABORATORIES PVT LTD
INTRODUCTION

- CSL is An ISO 9001-2008 Certified Company with over 2 DECADES of experience in Calibration gas and analytical instrumentation industry, with a state of the art production techniques, equipments and team of highly qualified professionals.

- Our specialty gas dept. offers from single component mixtures to more than 40 multi component gas/liquid mixtures from % to ppm level.

- Our instrumentation dept. manufactures gas chromatographs, Dissolve Gas Analyzers and portable analyzers suitable for Indian Condition at an affordable cost.

- Specialized gas handling equipments enables CSL to provide you with a complete solution for all your analytical problems
INTRODUCTION conti........

- CSL serves more than 2500 customers from various Industries like Refineries, Petrochemicals, Cement, Health Care, Power and Gas, Research Institutes Defence and Space Research (all over India) and is also exporting its products to overseas. It has Offices in Baroda, Delhi, Calcutta and Chennai, Pune & Hyderabad.

- For more details Contact Our Customer Support.
- sales@chemtron.net.in
- 022-67847300
- www.chemtronscience.com
Our Request

We are a company who has been manufacturing Supercritical CO2 Extraction Systems for the past 10 years. We started with experimental setup for our self. Being a manufacturing company we found it extremely useful for our Indian Industries. We manufactured these machines at costs economical to the pockets of the users and almost \( \frac{1}{4} \)th the cost of the foreign counterparts. We have supplied our machine pan India and some of our valuable customers are 1) GITAM University- Vishakhapatnam 2) Institute of Chemical Technology –Mumbai, 3) Pansari Flour Mills- Jaipur, 4) Barabanki, 5) Spiceor Neutralites – Cochin and 6) VMS Autotech – Delhi and many more have places orders for similar machines.

We request you to go through the configuration and give us an opportunity to manufacture this green technology machine in India for you.
CHEMTRON VERTICALS

1) GASES
2) ENGINEERING
3) ELECTRONIC
4) POST HARVEST DIVISION
5) PROJECTS and R&D
CSL POST HARVEST TECHNOLOGY IN A NUTSHELL

POST HARVEST TECHNOLOGIES

FRUITRON ETHYLENE RIPENING

+ CONTROLLED ATMOSPHERE

+ MODIFIED ATMOSPHERE

SUPER CRITICAL FLUID EXTRACTION SYSTEM
Specialized Products


2. Super Critical Extraction System for extraction of herbal plants, Aroma, Natural Color & Spices etc
SUPERCRITICAL FLUID EXTRACTION SYSTEM

FOR

Extraction of active ingredients in herbal plants, Aroma, Natural Colors & Spices
Complete Process For SCF Extraction

PROCESS CHART FOR SCFE EXTRACTION

SCFE SYSTEM
Extraction at respective temperatures and pressure

CO2 cylinder
Recycled CO2 Input to SCFE
Cleaned Filtered CO2

Fraction 1
Every fraction undergoes analysis on GC and HPLC
Required Fraction identified for the required Component of interest

Fraction 2

Fraction 3
Collect a single fraction which has all the components of interest

Further distillation and fractionation of the component to get a pure final product of interest
The product is packed as per its physical form and labeled and sold in the market as SCF extracted labeled product

www.chemtronscience.com
sales@chemtron.net.in, ashish@chemtron.net.in

Preprocessed Raw Product
Sourcing
Drying
Cleaning
Grinding
Sieving
Grading
1 Liter SCFE System
30L SCFE system
FLOW CHART FOR SCFE SYSTEM

FLOW DIAGRAM FOR 1L EXTRACTOR AND 100ML PRODUCT SEPARATOR
SUPERCritical CO2 EXTRACTION SYSTEM
SUPERCritical CO₂ EXTRACtion SYSTEM
20LX3 EXTRACTORS WITH 3LX2 PRODUCT SEPERATORS

FLOW CHART ONLY FOR UNDERSTANDING THE PROCESS
NOT AS PER PRODUCTION SCALE
150 L SCFE System

SUPERCritical CO2 EXTRACTION SYSTEM 150 L
BY
CHEMTRON SCIENCE LABORATORIES PVT. LTD.

FEATURES OF THE CONTROL PANEL
1) Safety cutoff of power supply to pump and machine.
2) Controls & measures heating of scf generator.
3) Controls & measures water circulation system.
4) Controls & measures individual separator heaters.
5) Controls CO2 pump & its flow rate.
6) Controls Chiller & its temperature.
7) The Control Panel displays all the above-mentioned parameters on a single display as well as on a connected computer.
All the parameters are programmable as per the requirement.
Pressure-temperature phase diagram for CO$_2$

Region for Supercritical CO$_2$ Extraction System

Supercritical

Critical Point

Subcritical

Solid

Liquid

Carbon dioxide

Water

Temperature (°C)

Pressure (MPa)

22.17.38

31.1

374

0.0006

SUPERCritical CO$_2$ EXTRACTION SYSTEM
HOW SCFE WORKS?

- **Principle of Operation:**
  - Carbon dioxide usually behaves as a gas in air at STP or as a solid called dry ice when frozen. If the temperature and pressure are both increased from STP to be at or above the critical point for carbon dioxide, it can adopt properties midway between a gas and a liquid. More specifically, it behaves as a supercritical fluid above its critical temperature (31.1°C) and critical pressure (73 bars), expanding to fill its container like a gas but with a density like that of a liquid and is called Supercritical CO2. This property that “expands in container as gas but with density like that of a liquid” is becoming an important commercial and industrial solvent due to its role in chemical extraction in addition to its low toxicity and environmental impact.
OPERATION STAGES OF SCFE

**Stage I**: From CO2 gas Feed Vessel, CO2 gas in liquid form will be fed to Refrigeration unit and gets cooled to (-) 15 deg centigrade.

- **Stage II**: Now High Pressure Liquid CO2 Pump sucks the Liquid CO2 from Refrigeration unit and compresses it up to 300 bar pressure and stores it in Liquid CO2 Receiver vessel.

- **Stage III**: Now high pressure Liquid CO2 gets heated with help of Heater unit up to 30 – 80 deg c and Supercritical fluid CO2 gets stored in CO2 SCF Vessel at 300 Bar pressure.

**Stage IV**: Now supercritical fluid CO2 enters in the already charged Extractor where temperature is maintained at 30 – 80 deg c and pressure at 300 Bar. In the extractor Supercritical fluid CO2 penetrates in the molecules of charged material (Clove, Ginger etc) and extracts their essence.
OPERATION STAGES OF SCFE

- **Stage V:** From extractor this essence of charged material along with supercritical fluid CO2 enters in the Extract recovery vessel. At extractor recovery vessel, temp and pressure is reduced to that extent so that supercritical fluid CO2 again gets converted into CO2 gas and thereby essence of charged material gets separated from the supercritical fluid CO2 and gets collected in the Recovery vessel.

- **Stage VI:** And left out CO2 gas gets re circulated in the system via refrigeration Unit

- **Stage VII:** Finally for complex analysis and characterization of natural and diversified bio products and extract, we test the extract composition with the help of our laboratory which is equipped with latest and state of art lab instruments such as gas Chromatograph and various other instruments
## Comparative Study

<table>
<thead>
<tr>
<th>No.</th>
<th>Solvent extraction</th>
<th>Supercritical Fluid Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solvent presence is unavoidable. The residual ppm level of the solvent depends on the type of solvent used.</td>
<td>Is totally free of solvents and hence very pure</td>
</tr>
<tr>
<td>2</td>
<td>Heavy metal content is also unavoidable and depends on the solvent, the recycle method for the solvent, the source of the raw material, and the</td>
<td>Totally free of heavy metals since they are not extractable even if they are present in the raw material.</td>
</tr>
<tr>
<td></td>
<td>Inorganic salt content cannot be avoided, using the same concept as above Polar substances get dissolved along with the lipophilic substances from the raw material due to poor selectivity of the solvent. During solvent removal operation, these polar substances form polymers, which lead to dark color of extract and poor flow characteristics. All this renders the extract to look different from the basic components in the raw material and hence it is more of a &quot;pseudo&quot; natural extract.</td>
<td>Totally free of inorganic salts using the same explanation as above No such possibility since there is very high selectivity of CO2 and no chance of polar substances forming polymers. In addition the operating temperature is only 40-50 degree Celsius.</td>
</tr>
</tbody>
</table>
## Comparative Study

<table>
<thead>
<tr>
<th></th>
<th>Both polar as well as non polar colors are extracted</th>
<th>Only non polar colors get extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Solvent removal requires extra unit operations and hence the cost and recovery of useful material is lower</td>
<td>No extra unit operations needed and yield of useful material is very high</td>
</tr>
</tbody>
</table>
TECHNICAL DETAILS

• **Specifications**
• **Extraction vessels:**
  • Operating Pressure: Upto 400 BAR
  • Design Temperature: 80DegC
  • Volumes of Extraction Vessel (W/C) : 0.1 – 0.5L/1L/2L/5L/10L/20L/30L/100L/300L
  • Design Code: ASME Sec. VIII Div. II
  • Material of Construction: SS 316
• **Liquid CO2 Pump:**
  • Operating Pressure: 500 BAR
  • Discharge Capacity: Variable
  • Drive: Mechanical
  • Material of construction: SS/PTFE
TECHNICAL DETAILS

• **High Pressure Product Separator:**
  • **Design Pressure:** upto 300 BAR
  • **Operating Pressure:** upto 250 BAR
  • **Design Temperature:** 250 deg C
  • **Volumes of Separation Vessel:** 0.1 –0.5L/1L/2L/5L/10L/20L
  • **Design Code:** ASME Sec. VIII Div. II
  • **Material of Construction:** SS 316

• **Piping, Valves & High Pressure Regulator:**
  • **Material of Construction:** SS 316
  • **Fitting:** Swagelok
  • **Protections:** Isolation valves, Safety Valves
  • **Rated for:** Up to 1200 BAR
Applications of SCF Extraction Technology

- It includes
  - Extraction of herbal medicines
  - Extraction of Spice aroma or flavor (essential oil/essence) of Red Chili, Paprika, Ginger, Nutmeg, Black pepper, Vanilla, cardamom, Fennel, areaway, Coriander, Garlic, Cinnamon, etc.
  - Decaffeination of coffee and tea
  - Deodorization of oils and fats
  - Extraction of oil from contaminated soil.
  - Studying various enzymatic reactions in supercritical CO2.
  - De-greasing of sensitive metallic parts.
Applications of SCF Extraction Technology

- Extraction of vegetables oils from flaked seeds and grains
- Flavors, fragrances, aroma and perfumes
- Hops extraction for bitter
- Stabilization of fruit juices
- Lanolin from wool
- De oiling of fast foods
- De cholesterolization of egg yolk and animal tissues
- Antioxidants from plant botanicals
- Natural pesticides
- De nicotinization of tobacco
- Extraction of vitamin E from soybean oil.
- Polycosinols from rice bran wax.
- Extraction of spice oils and flavors.
Applications of SCF Extraction Technology

- Soil remediation and activated carbon regeneration.
- For removal of organics from contaminated soil.
- Extraction of inorganic species
- Recovery of organics from oil shale, separations of biological fluids,
- Bio-separation
- Recovery of essential oils from wastes.
- Cleaning of oils from high precision metal parts.
ENABLING TECHNOLOGY

Supercritical Fluid Extraction technology (SFE) based on CO2 as fluid is widely used in food and spices extraction, Pharmaceutical, Naturopathy and environmental industries.

Food applications:

- Carbon dioxide is the most common supercritical fluid in the food industry. Due to the is used as a replacement for hexane in extracting soybean-oil and has been tested non-toxicity and low critical temperature, it can be used to extract thermally labile food components and the product is not contaminated with residual solvent. Further, the extract’s color, composition, odor, texture are controllable and extraction by supercritical fluid carbon dioxide retains the aroma of the product. Supercritical carbon dioxide extraction for extraction from corn, sunflower and peanuts. Supercritical fluid extraction provides a distinct advantage not only in the replacement but also extracts oils that are lower in iron and free fatty acid. To satisfy the consumer's need for 'lighter' foods, developmental work on supercritical extraction of oils from potato chips and other snack foods are been carried out. In addition, supercritical carbon dioxide has also been used to extract lilac, essential oils, black pepper, nutmeg, vanilla, basil, ginger, chamomile, and cholesterol.
Pharmaceutical Applications:

- Since the residual solvent present in the extracted material is of critical importance in the pharmaceutical industry, supercritical fluid carbon dioxide has found several applications. The extraction of vitamin E from soybean oil and a purification method for vitamin E has been well studied. The latter process avoids the step of vacuum distillation, which usually results in the thermal degradation of the product. Solubilities and recrystallization of various drugs has been demonstrated in supercritical fluids.
Application in Naturopathy:

- Nutrition plays a vital role in strengthening the body’s immune system. These nutrients ought to be close to their original form so that they create the least disturbances in body systems. Consequently it is preferred that they be derived from natural source, in the form of natural extracts. But while extraction with help of conventional extraction methods, compelling regulations on the usage of hazardous, carcinogenic or toxic solvents have curtailed the growth of natural extract industries. However now SFE Extraction Technology by CO2 has emerged as the alternative to the traditional solvent extraction of natural products. It uses CO2 gas as solvent, which is clean, safe, inexpensive, nonflammable, nontoxic, environment-friendly, and nonpolluting solvent.
Environmental Applications:

- Due to strict environmental regulations, supercritical fluids are used as replacements for conventional hazardous chemicals such as hexane. Supercritical fluid extraction has been proposed as an alternative technique for soil remediation and activated carbon regeneration. Over 99% of a majority of organics can be removed from contaminated soil. Organics that have been successfully extracted include PAHs, PCBs, DDT and toxophene. Carbon dioxide has been used with entrainers for the extraction of highly polar compounds. A commercial process to separate oils from refinery sludge and contaminated soil has been developed by CF Systems Corporation, USA. Chelating moieties that dissolve into carbon dioxide have been developed for the extraction of heavy metals from soil.
CSL ACHIEVEMENTS

30 LITER SCFE SYSTEM
MODEL NO: CSL/SCFE450/30L
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>NAME OF ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HIGH PRESSURE REGULATOR</td>
</tr>
<tr>
<td>2</td>
<td>HOT &amp; COLD WATER CIRCULATION SYSTEM</td>
</tr>
<tr>
<td>3</td>
<td>LIQ CO2 RECEIVER</td>
</tr>
<tr>
<td>4</td>
<td>SEPERATOR</td>
</tr>
<tr>
<td>5</td>
<td>SUPER CRITICAL GENERATOR</td>
</tr>
<tr>
<td>6</td>
<td>EXTRACTION VESSEL</td>
</tr>
<tr>
<td>7</td>
<td>REFRIGERATION UNIT</td>
</tr>
<tr>
<td>8</td>
<td>HOT WATER GENERATOR</td>
</tr>
<tr>
<td>9</td>
<td>HIGH PRESSURE LIQ CO2 PUMP</td>
</tr>
<tr>
<td>10</td>
<td>CO2 CYLINDER</td>
</tr>
</tbody>
</table>
LIST OF OUR EXTRACtIONS

- CLOVE BUD – 19%
- Commi Phora Myrrha – 4%
- Sasurea Radix (root) – 3%
- Jatamansi Valeriana – 3%
- Turmeric --- 6% OIL
- Turmeric -- CURCUMINE – 2%
- MARIGOLD - 2%
- KHUS --- MORE THAN 3%
- Ginger Oil----4.5%
- Cardamom Oil----5.7%
- Ginger Oil------6-7%
Innovative content in the proposed activities

- Our innovation efforts are mainly attributes to make this very costly imported system to cost effective and make available to Indian Entrepreneur at affordable price. Secondly our innovation efforts are address to make this high tech sophisticated system to suit the Indian environment. Thirdly we are putting our innovation efforts to make the system user friendly and make simplified system so that anybody can operate it.

- this connection we have to develop extraction vessels of various types and adopt which is going to best suitable under specific applications. We have also to develop a cooling system by using available gas compressor from the market and make a system, which can easily liquefy the CO2, and CO2 can be pumped easily by ordinary Liquid pumps. This has resulted very low cost of pumping system. The further we have to develop high-pressure regulators and other gas handling devices for controlling the flow of CO2. This has resulted the whole system cost effective.
Knowledge gaps

- The systems developed so far available in market are very costly and are not suitable to Indian environment conditions. In order to proliferate this high tech system in India to the grass root level and to exploit this technology commercial on large-scale basis in India, it is very much essential that the SCFE based system must be available at affordable price, rugged in nature, user friendly to suit Indian environment. This technical know-how gap needs to be filled by Indian entrepreneur only. We are putting all efforts with the help of our in house R & D efforts to bridge this gap.
Technological challenges

Since SCFE based Extraction Plant technology has huge potential in all field of frontier areas of Science namely manufacturing of Nanoparticles, Pharmaceutical research advancement, extraction of nuclear material etc. So all these challenges are there which still have been left unexplored.
Plan of action to overcome the technology barriers

As a plan of action, we will continue to peruse our R&D efforts in all these frontier area of science by keeping our touch with all the advance development at international as well as national level. In order to keep interacting with all leading scientists, we will keep visiting various seminars and participating in all leading exhibitions with our latest developed Pilot plant based on SCFE technology. At the same time we

- At the same time we will keep continue our efforts to promote our sales of our SCFE system to our clients and collecting their valuable feedbacks to improve our SCFE Pilot Plant to make it of International level and then we will enter in International market in big way.
We have carried out market survey in various manner either by sending our pamphlets or sending by our sales engineers through out in India. Based on encouraging response we are of the opinion that there is tremendous scope for commercial utilization of SCFE technology and that is why we developed our SCFE based Pilot Plant and started offering our services for extracting the extraction of various species which we were receiving from visited our sites also to see the demonstration of our Pilot Plant. Meanwhile we started receiving orders for SCFE based Plants. Our first SCFE based plant is going to be dispatched very shortly at the end of Nov07 month. For your kind reference the query letters received from various parties.
Export possibilities and global competition

• Because of wide price difference there is tremendous export possibilities are in this line. In this connection, we have received queries for our SCFE based extraction plant from Malaysia and New Zealand. Once the technology will be fully developed we are confident that because of wide price difference we will get number of orders for SCFE based Extraction Plant. Besides this tremendous scope for export of extraction oil/essence, which will be extracted by our clients by using our SCFE based extraction plant. So indirectly also we are going to contribute in overall growth of export business of India there is
# OUR CUSTOMER LIST

<table>
<thead>
<tr>
<th>No.</th>
<th>Company Name</th>
<th>Contact Person</th>
<th>Address</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SHREE FLAVOUR &amp; ESSENTIAL OIL</td>
<td>Mr. CHETAN PANDEY</td>
<td>13, avas vikas colony chota chouraha hardoi hardoi (U.P)- 241001, India</td>
<td>India</td>
</tr>
<tr>
<td>2</td>
<td>KURAT ENTERPRISE</td>
<td>Mr. Yusuf E. Jangbar</td>
<td>67/69, Jubilee Building, Opp. Kalyan Building, P.B. Marg, Near Jamali Hospital (Manaziyeh Mohammediyah), Grant Road, Mumbai - 400 008. INDIA</td>
<td>India</td>
</tr>
<tr>
<td>3</td>
<td>ALCHEMY CHEMICALS</td>
<td>Mr. G. MAHESH</td>
<td>31/04 &amp; 31/06, Industrial Area, Maksi Road, Ujjain-456 010</td>
<td>India</td>
</tr>
<tr>
<td>4</td>
<td>Veg India Exports, Erode</td>
<td>Mr. Ramesh</td>
<td>106, Prakasam Street, &gt; &gt; &gt; &gt; Erode-638 001, Tamil Nadu, India</td>
<td>India</td>
</tr>
<tr>
<td>5</td>
<td>Craig</td>
<td></td>
<td>new zealand Phone: 00640273311702</td>
<td>New Zealand</td>
</tr>
<tr>
<td>#</td>
<td>Company Name</td>
<td>Contact Name</td>
<td>Address</td>
<td>Country</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------</td>
<td>------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>6</td>
<td>Classic Sales</td>
<td>Mr. Rakesh</td>
<td>M-5, New Madhav Pura Market, Shahibaug Ahmedabad - 380 004, Gujarat, India</td>
<td>India</td>
</tr>
<tr>
<td>7</td>
<td>Ecotech Technologies (I) Pvt. Ltd</td>
<td>Mr. Bimal</td>
<td>Shop No. 3, Building No. 7A Sangeeta Apartment, Juhu Road Santacruz (W) Mumbai 400 049, India</td>
<td>India</td>
</tr>
<tr>
<td>8</td>
<td>M. M. Abdul Hameed &amp; Sons</td>
<td>Mr. M. M. Abdul Hameed &amp; Sons</td>
<td>Hameed Estate, Ashokapuram, P. B. No. 12, Alwaye Eranakulam - 683 101, Kerala, India</td>
<td>India</td>
</tr>
<tr>
<td>9</td>
<td>Sharad Agencies</td>
<td>Mr. Shashikant Padamwar</td>
<td>210, Paras Chambers, Above Bank of India, Near Laxminarayan Cinema, Pune-411009 Pune- 411 009 , Maharashtra, (INDIA)</td>
<td>India</td>
</tr>
<tr>
<td>10</td>
<td>Sai Phytoceuticals Pvt. Ltd.</td>
<td>Mr. Anil G Bhansali</td>
<td>S-553, Greater Kailash Part - II, New Delhi- 110048, India</td>
<td>India</td>
</tr>
</tbody>
</table>
NEW EXTRACTOR UNDER CONSTRUCTION
FRAME FOR NEW SCFE PLANT UNDER CONSTRUCTION
LITERATURE FOR REFERENCES

- Aloe Vera supercritical carbon dioxide extraction
- Ashwagandha (*Withania somnifera*)
- Isolation of Eugenol from Cloves by Steam Distillation and its Identification by Infrared Spectroscopy
- Curcumin Herb (Turmeric Extract / Oleoresin)
- Natural Extracts Using Supercritical CO2 Extraction by Mamata Mukhopadhyay
### SOME COMMERCIAL SPICE EXTRACTS

<table>
<thead>
<tr>
<th>SN</th>
<th>SPICE</th>
<th>ESSENTIAL OIL RANGE</th>
<th>OLEORESINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CARDAMOM</td>
<td>4-10 %</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CARROT</td>
<td>0.5-0.8 %</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CINAMONE</td>
<td>1.6- 3.5 %</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CLOVE BUD</td>
<td>14- 21%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>CORIANDER</td>
<td>0.1 – 1%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CUMIN</td>
<td>2.5 – 5%</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CURCUMA</td>
<td>2.0 – 7.0 %</td>
<td>7.9- 10.4 %</td>
</tr>
<tr>
<td>8</td>
<td>GINGER</td>
<td>0.3 – 5%</td>
<td>3.5 – 10%</td>
</tr>
<tr>
<td>9</td>
<td>NUTMEG</td>
<td>2.6 – 12%</td>
<td>18 – 35 %</td>
</tr>
<tr>
<td>10</td>
<td>PEPPER</td>
<td>1 – 3.5 %</td>
<td>5-15 %</td>
</tr>
<tr>
<td>11</td>
<td>SAFRON</td>
<td>0.5 – 1.0 %</td>
<td></td>
</tr>
</tbody>
</table>
INSTRUMENTATION REQUIRED

- GC - FOR VOLATILES
- GC-MS : FOR UNKNOWN AND QUANTIFICATION
- HPLC : FOR QUANTIFICATION
Typical Configuration of SCFE System

- Extractors: ss316 10L volume x A numbers Pressure up to 450 bars.
- Separators: ss316 10L volume x B numbers Pressure up to 250 bars.
- Liquid CO2 Pump: ss316 plunger type maximum pressure 450 bars.
- Supercritical CO2 Generator
- Hot water circulation for a) SCF Generator + extractors b) Separators 1 or 2 or 3. Generally 3 in number.
- Pressure Regulators and back pressure regulators.
THANK YOU

CALL : 022-67847300
EMAIL: ripe@chemtron.net.in
WEB: www.chemtronscience.com