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# ACADEMIC AND EMPLOYABILITY SKILLS FOR ENGINEERS

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11 NOVEMBER 2024



APPENDIX GA36b

LEVEL 4 ASSESSMENT SPECIFICATION

|                      |                                                   |                                                      |              |
|----------------------|---------------------------------------------------|------------------------------------------------------|--------------|
| Student name:        | Nariman Ramadhan                                  | Student ID number:                                   | RAM20849142  |
| Programme:           | HNC/HND in Electrical and Mechanical Engineering. |                                                      |              |
| Module               | Engineering Applications and Study Skills         |                                                      |              |
| Module code:         | GOEN 4000                                         | Contribution to Overall Module Assessment (%):       | 40%          |
| Lecturer:            | Calvin Williams                                   | Internal Verifier:                                   | Rabya Kadhim |
| Assignment Title:    | Academic and Employability Skills for Engineers.  | Word count (or equivalent);                          | 2000         |
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|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Submission method:</b>             | <p>All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.)</p> <p>Alternative submission method (if applicable):</p> <p>Late submission of the assessment will result in a late penalty mark. Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.</p> |
| <b>Academic honesty/ referencing:</b> | <p>Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.</p>                                                                                                                                                                                                                                                                                |

| <b>Module Learning Outcomes (from module syllabus)</b>                                                                                                                                                                                  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>Demonstrate transferable skills in a learning environment. Apply an academic, positive and professional approach to their studies. Identify suitable and relevant sources of information to meet a research topic of your choice</p> |  |

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Ram 20849142

11<sup>th</sup> Nov 2024

## Table of Contents

|                                                                     |          |
|---------------------------------------------------------------------|----------|
| <b>Contribution to Overall.....</b>                                 | <b>1</b> |
| Understanding learning style .....                                  | 4        |
| VARK Learning Style .....                                           | 6        |
| VARK and Online Learning .....                                      | 6        |
| VARK Learning Style in Learning Process .....                       | 7        |
| Skills Self-Assessment Audit – Developing my LinkedIn Profile ..... | 8        |
| Research and Analysis .....                                         | 9        |
| Profile Creation.....                                               | 9        |
| Personal development plan .....                                     | 11       |
| Solid – liquid separation technology.....                           | 13       |
| Solid-liquid separation techniques: .....                           | 14       |
| Power point presentation.....                                       | 29       |

### Task 1.

#### Understanding learning style

Understanding learning styles means realizing that people have preferences about how they learn, process, and remember information. These can be visual (whereby a learner learns through images and diagrams), auditory (through sound and speaking), read/write (where information is learned through reading and writing), and kinaesthetic (where individuals learn through hands-on experience and motion). Everyone may be drawn towards one or more styles that affect the way they perform in learning tasks and engaging themselves with material. Being aware of and understanding your own style allows you to reflect upon and adapt study skills that help improve retention of knowledge and increase your overall experience as a learner. Knowing varied styles enables instructors to devise effective learning plans that would ensure students who could stand a chance otherwise stand the best chance.

| Preferred Learning Styles | Your Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Visual                    | Visual learning is a style whereby one learns best through what is seen, like images, diagrams, and charts. Visual learners prefer to have text accompanied by visuals and also benefit from tools like mind maps and flashcards. They do well in tasks that require spatial reasoning and mental visualization. Color-coding and highlighting are other strategies that help them organize information. Videos, animations, and illustrated notes are also effective. These learners process and recall visual details much easier than auditory or tactile ones. Being able to recognize this style in education can improve comprehension and engagement. |
| Aural                     | The aural learning style involves preferring to learn through listening to spoken explanations, discussions, and sounds. Aural learners do well with lectures, group discussions, and audio tools such as recordings or podcasts. They often use verbal repetition, reading aloud, and music to help them remember. Incorporating auditory elements in teaching helps these learners engage and succeed effectively.                                                                                                                                                                                                                                         |

|                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Read/Write                                                        | The read and write learning style involves a preference for learning through written words, either reading texts or writing notes. These are the people who learn best when using materials like textbooks, lists, and summaries, and the ones who benefit from note rewriting or using text-based revision tools such as flashcards. Providing written resources and opportunities for written tasks enhances their learning.                                                                                                                                                                                                              |
| Kinaesthetic                                                      | The kinaesthetic learning style involves learning through hands-on activities, movement, and physical engagement. These learners excel with practical tasks, experiments, and real-world applications. Active learning strategies, such as using tools or role-playing, enhance their understanding and retention.                                                                                                                                                                                                                                                                                                                          |
| Multimodal                                                        | The multimodal learning style refers to the preference for using a combination of different learning styles to absorb and retain information. Learners with this style use a mix of visual, auditory, read/write, and kinaesthetic methods to understand concepts. They may switch between learning styles depending on the situation or content. This flexibility allows for deeper engagement with the material and utilizes the method most appropriate for the task at hand. Multimodal learners often benefit from varied instructional methods such as videos, discussions, hands-on activities, and reading.                         |
| <b><i>What is identified as your preferred Learning Style</i></b> | "My learning style is multimodal, which simply means that I learn best through a combination of different methods. Maybe I would understand through visual means like diagrams or charts; then again, sometimes just listening to an explanation or discussion makes things clear for me. I also read to get a deeper understanding and even take notes. Sometimes, doing some hands-on activity just to make the material come alive helps. I switch among these methods, which really helps me to keep on track and to better internalize information. It's rather flexible; it allows me to change according to tasks and environments." |

## VARK Learning Style

According to Neil Fleming, the VARK model highlights four clear learning-style modalities: Visual, Aural, Read/Write, and Kinaesthetic. These learning approaches define the perception of people and their treatment toward received information and thus may help offer a framework that could assist educators in providing varied approaches for students. The VARK model says that individuals have one or more preferred learning styles that could guide teachers or educators in adjusting their teaching styles to suit the needs of different learners. It has to be taken into consideration, however, that even though VARK gives a useful framework, the notion that learners have fixed styles is open to debate. Some believe that a person can benefit from a blend of styles and that learning approaches need to be flexible and attuned to the context in which they appear.

## VARK and Online Learning

In an online learning environment, the leaning seems to be more toward the Visual and Read/Write learners because most of them are based on written material, videos, and assignments in digital form. Online classes tend to offer less opportunities for Aural learners to interact with audio and Kinaesthetic learners to engage in hands-on activities. This may be the reason why students with Visual and Read/Write preferences may do better in online courses than Aural and Kinaesthetic learners, who may find it harder to adapt to the virtual setting.

The Aural learner, for whom face-to-face interaction and auditory materials are very important, may also have a difficult time, and the Kinaesthetic learners may miss hands-on and physical contact in a physical learning environment. But the instructor may make modifications in the online learning material to fit these learning styles by including video lectures, audio recordings, interactive simulations, and virtual labs.

The knowledge of the VARK learning styles has implications for designing effective learning in both online and traditional settings. Tailoring educational content to different learning preferences may lead to increased engagement and better learning outcomes among diverse student populations.

This research seems to indicate that while learning styles do make a difference in students' preferences of online learning environments, they do not particularly influence either test performances or course completion. This therefore is an important consideration for educators and instructional designers who, other than trying to accommodate different learning

styles, should also put in efforts towards enhancing the quality of content delivery, engagement, and interaction of online education systems. With the continuous development of online education technologies, future research could present deeper insights into how to adapt such environments to better support diverse learning preferences and improve overall educational outcomes. (Ermira Idrizi 2018)

## VARK Learning Style in Learning Process

Bachok et al. (2000) have found that unmatched lessons and learning styles result in poor learning and behaviour of the students. Pritchard (2005) stated that the effectiveness of learning is not only due to the learning styles of students but also because of the learning materials used, and that teaching materials should be designed to suit the learning styles. Yahaya (2007) also proposed that teachers should try different proactive approaches to hold the interest of students with different learning preferences. This is further supported by the Adaptive Learning Theory, where the teaching strategy needs to adapt according to the learning style of the individual students. The Preferred Sensory Modality Theory (Ismail, 2008) also acknowledges that one learns best through one's preferred sense of sensory input. This fits in with the VARK model, which shows how multimedia courseware can help improve the learning process because it makes different learning styles possible.

Fleming, 1995 explained that aural mode is most in use while learning, but kinaesthetic mode is not emphasized at a higher level of studies. Fleming and Mills, 1992 explained that courseware based on the VARK model can enhance learning as it supports different modes such as visual, auditory, and kinaesthetic modes. According to Fleming, 2006, teachers find difficulty in preparing material for different learning styles because it is very time-consuming. According to Virileen, 2010, a VARK model in creating multimedia teaching aids motivates the learners and also improves learning. (Norasmah Othman 2010)

### **Several factors influence learning and these include:**

- a) Learning Style: The preference for visual, auditory, reading/writing, or kinaesthetic learning (VARK)
- b) Motivation: Generally driven by intrinsic or extrinsic reason(s) to learn
- c) Knowledge acquired previously: Knowledge one already has and experiences that influence a new learning
- d) Cognitive capacity: Skills such as the memory, attention, or critical thinking
- e) Emotional aspects: Anxiety, Stress, and Confidence levels
- f) Teacher Quality: teaching methods and effectiveness
- g) Learning Environment: Classroom setting and access to resources
- h) Social/ Cultural Factors: Family, Peers, and Cultural Influences.

Nariman Ramadhan

Ram 20849142

11<sup>th</sup> Nov 2024

- i) Technology: Utilization of digital tools and multimedia.
- j) Health and Well-being: Impacts on physical and mental health.
- k) Study Habits: Time management and organization.

(Hofstein 1994)

| How can you use what you have learned to aid you in your studies? |                                                                                                                                           |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Taking information in</i></b>                               | By Write notes and highlight important information to focus on key points.                                                                |
| <b><i>Studying &amp; Revising</i></b>                             | By Test myself or ask someone to quiz me. Read aloud to improve memory retention.                                                         |
| <b><i>In exams or class test situation</i></b>                    | Read the questions carefully, repeat them a few times to fully understand, and allocate time for each question to avoid panic and stress. |

## Task 2

### Skills Self-Assessment Audit – Developing my LinkedIn Profile

#### Instruction

The creation of my LinkedIn profile has been an insightful and rewarding experience. It allowed me to reflect on my professional journey, assess my strengths, and position myself effectively in the competitive job market. Below, I detail the steps I took and the considerations that guided my approach.

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Ram 20849142

11<sup>th</sup> Nov 2024

## Research and Analysis

First, I have looked through a few LinkedIn profiles, analysing the most engaging profiles that had been structured appropriately and whose owners could clearly state their skills and achievements. Some of the important practices I found were:

- A profile picture which conveyed confidence and friendliness.
- A headline that summarized expertise or career aspirations.
- A summary that had been crafted to showcase one's value proposition.
- Specific, quantifiable achievements in the experience section.
- Recommendations and endorsements from colleagues and bosses.

These ingredients encouraged me to include similar techniques in my profile.

## Profile Creation

- I. **Headline:** I came up with a summary that best defines my present position and career aspirations. My goal was to make a strong first impression by succinctly summarizing who I am and what I bring to the table.
- II. **About Section:** The summary was an opportunity to tell my story. I underlined my key skills, professional values, and career objectives. I tried to balance being personable with professionalism.
- III. **Experience and Education:** I included my academic background and professional experience, focusing on specific accomplishments and responsibilities. Where possible, I included quantifiable metrics to demonstrate the impact of my work.
- IV. **Skills:** Some of the technical and soft skills relevant in the field, apart from seeking endorsements from peers and mentors to validate my expertise in those skills.
- V. **Projects and Portfolio:** Key projects that align with my career goals, including descriptions to give context and add value to potential viewers.
- VI. **Networking:** I networked with professionals, classmates, and mentors. Furthermore, I participated in the posting and the posting of articles to show the activity of my existence.

The finished profile on LinkedIn represents me professionally, highlighting my skills, experience, and goals. It also acts as an avenue to be taken where connections are made among colleagues, potential employers, and business leaders. Feedback from friends/colleagues on the impact of the profile shows that it is well and effectively presented.

Nariman Ramadhan

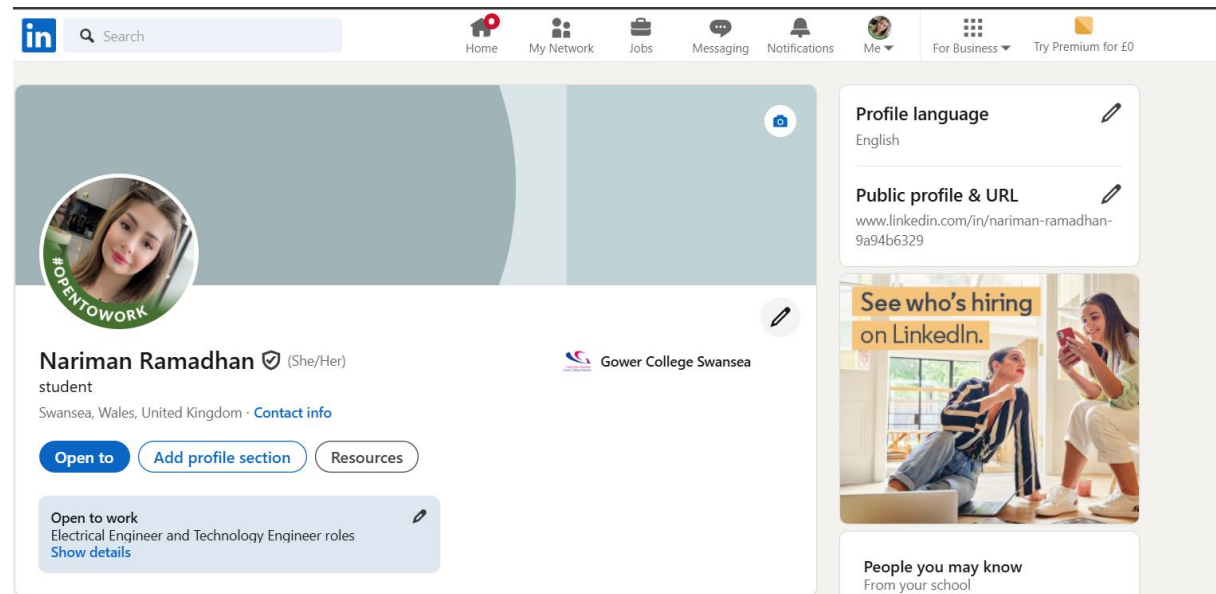
Ram 20849142

11<sup>th</sup> Nov 2024

### My Future Plans

I will continue updating my profile as I experience more and achieve more. I would also like to keep expanding my network and sharing content to show my activity within the platform.

**In conclusion** the exercise has not only improved my presence online but has also provided an understanding of what I am all about professionally. It has reinforced the notion of personal branding and networking within career development.



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11<sup>th</sup> Nov 2024



Nariman Ramadhan (She/Her)  
student

Resource

## About



I am a hardworking, motivated individual committed to achieving the highest standards both in my academics and my career. I am highly eager to learn new skills, manage many tasks, and rise to a challenge with a great attitude. Presently, I am an apprentice at Tycoc, Gower College Swansea, studying HND Level 4 & 5 Electrical and Electronic Engineering.

## Activity

0 followers

Create a post



Nariman Ramadhan • You



student  
3mo • 🌐

I'm happy to share that I've started my HND at [Gower College Swansea!](#)



## Task 3

### Personal development plan

#### Abstract

The personal development plan presented here outlines some of my key goals for the next 3-6 years regarding financial stability, family growth, entrepreneurship ambitions, and academic pursuits. Setting specific objectives, clear steps, and realistic timelines for these objectives are ways I look forward to living a well-rounded and fulfilling professional and personal life.

| Goal Number | Short and medium term                                    | Action required                                                                                                     | Constraints                                  | Resources – who or what can help me?                            | Target dates for action            |
|-------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------|------------------------------------|
| 1           | Try to pay my mortgage in 3-5 years.                     | - Create a detailed budget plan. - Increase income through side jobs or investments. - Reduce unnecessary expenses. | Financial stability and unforeseen expenses. | Financial advisor, budgeting tools, supportive family members.  | Mortgage paid off: Year 5.         |
| 2           | Have another child in 4-6 years.                         | Ensure financial and emotional readiness. - Consult healthcare professionals. - Prepare the home environment.       | Health factors and financial readiness.      | Healthcare providers, family support, parenting resources       | Child born: Year 6.                |
| 3           | Open my own business in 3-5 years.                       | - Research business opportunities. - Develop a business plan. - Secure funding and build a network.                 | Market risks and initial investment costs.   | Business mentors, funding institutions, industry networks.      | Business launched: Year 5.         |
| 4           | Continue my studying journey and earn a master's degree. | - Research programs and universities. - Apply for scholarships or financial aid. - Manage time effectively for      | Balancing work, study, and personal life.    | Academic advisors, online learning platforms, employer support. | Master's degree completed: Year 6. |

|  |  |                 |  |  |  |
|--|--|-----------------|--|--|--|
|  |  | work and study. |  |  |  |
|--|--|-----------------|--|--|--|

## Conclusion

This plan is designed to serve as a roadmap to guide my personal and professional development. By tackling each goal with strategic actions and leveraging available resources, I am committed to overcoming potential constraints and achieving meaningful progress. Continuous reflection and adaptability will ensure that I stay aligned with my aspirations and values.

## Task 4

### Solid – liquid separation technology

#### ABSTRACT

Solid-liquid separation is a fundamental process that finds widespread applications in many industries, such as water treatment, food processing, and mineral treatment. This report provides a detailed review of the principles and methods applied to achieve efficient separation. The primary objective is to explain the principles of the separation process, classify the various techniques, and assess their principles of operation. This study is based on five major techniques: filtration, sedimentation, hydrostatic pressure, flotation, and magnetic separation. Each of the techniques is supported with appropriate images and short descriptions for better understanding. This paper systematically presents methodologies that could serve as a useful document for practitioners and researchers involved in the study of optimizing separation processes. The examination brings out the effectiveness and adaptability of each method within particular contexts, thereby providing valuable insights into their real-world applications. The compilation helps in ensuring access to reliable information about solid-liquid separation technologies, enabling innovation and knowledge-based decisions in the relevant field.

#### INTRODUCTION

Solid-liquid separation technology is important in food, pharmaceutical, chemical, and environmental processing. It can be defined as a separation technique by which solid particles are removed from liquid solutions or suspensions to obtain a pure product or to enhance the subsequent technological process. Filtration, sedimentation, centrifugation, and sterilisation with membranes or active substances are some ways of providing such a separation.

There are indeed a lot of different methods to separate solids and liquids, and the choice of which method to use depends on the properties of the solids to be separated about their volume, density, and shape, as well as those of the liquid regarding viscosity and density.

Nariman Ramadhan

Ram 20849142

11<sup>th</sup> Nov 2024

Examples of methods include filtration-used for large volumes of particles-and centrifugation, very effective in separating very fine particles.

Knowledge of these techniques and their effective application contributes not only to the improvement of the performance of a wide range of industrial processes, but also to minimizing the generation of wastes and improving the purity of the final product. In general, the selection and design of solid/liquid separation equipment can be initiated when a representative sample of suspension is available, together with preliminary tests from jar sedimentation and leaf filter tests. At this stage, consideration may be given to modifying the suspension by chemical or physical treatment methods to improve its settling or filtration characteristics. Results from these are in the form of a sedimentation rate and sediment volume from jar tests, and filtration rate, and cake moisture content from leaf tests. Filtration rate is sometimes expressed via a specific cake resistance, or cake form time. It is becoming increasingly important that the process engineer has a 'feel' for what is behind these measurements that is, a basic understanding of the phenomena which dictate whether a suspension is easily separable-so that he or she is better able to manipulate the suspension.

**Separation:** The various processes for separating the components in a mixture into individual components depend on the properties physical or chemical. The individual separation could include the separation of the solids from the liquid, and vice versa, and some include separation of the components even if they are already in their gaseous stage. Different separation techniques, therefore, depend on what type of mixture one would deal with and also would be differentiated by characteristic properties in which each component differentiates. (Steve Tarleton, 2007)

## Solid-liquid separation techniques:

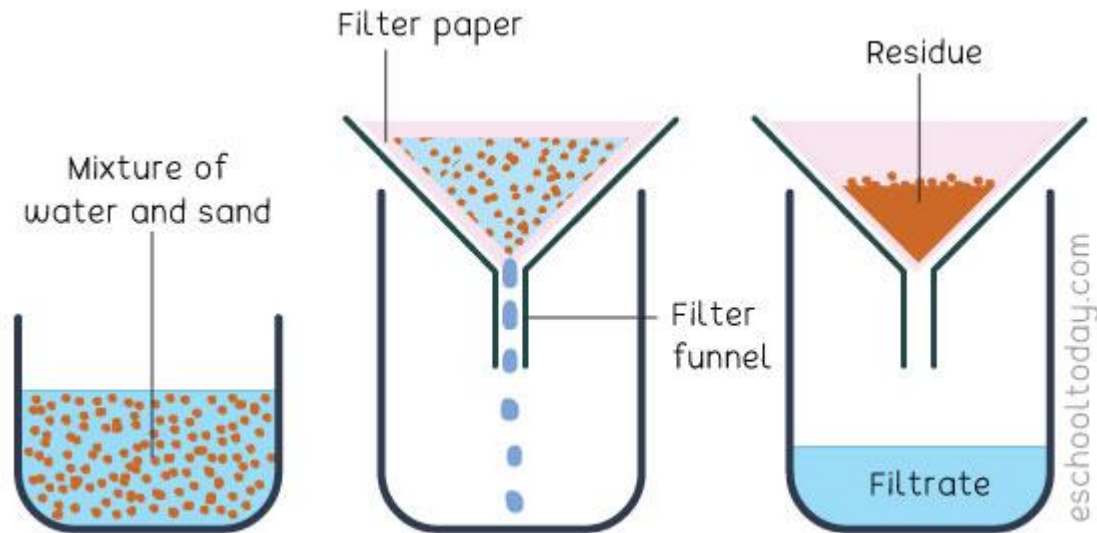
### 1. Filtration

**Filtration:** is a mechanical process used to separate solids from liquid through the passage of the mixture through a porous medium that allows the passage of liquid and retains solids.

Basic approaches in the mechanics of solid-liquid filtration boil down to two alternatives, namely: separating liquids from solids or filtering solids from liquids. This might well suggest employing one of two basic solutions:

1. Either the solids tend to go one way and the liquid the other way (i.e., separation), or
2. A hole smaller than the solids to be captured should be found - i.e., filtration.

(Perlmutter, 2015)



filtration is a common method to separate solid and liquid components from a mixture. It has distinct advantages and disadvantages depending on the context and the specific materials involved.

**Advantages:**

- a) **Efficiency in Separation:** Filtration is very effective in separating insoluble solids from liquids, even for very small-sized particles, provided the filter medium is appropriately chosen.
- b) **Wide Applicability:** It works across a wide range of industries that include water treatment, pharmaceuticals, and chemical production.
- c) **Low Cost:** Basic filtration setups can be very cheap and simple to run.
- d) **Scalability:** It can be scaled for small laboratory setups or large industrial processes.
- e) **Preservation of Components:** It's possible to recover both liquid filtrate and solid residue according to their value.
- f) **Minimal Chemical Requirements:** The process of filtration itself does not require supplementary chemicals, thus being ecological compared to other methods of separation.
- g) **Control of Separation Quality:** The quality of the separation can be controlled by adjusting pore size and material of the filter.

**Disadvantages:**

- a) **Filter Media Clogging:** The filters can be clogged, especially with fine particles or sticky solids, reducing efficiency and requiring frequent cleaning or replacement.
- b) **Not Suitable for Dissolved Solids:** Filtration cannot separate dissolved solids or very fine colloids from a liquid.

Nariman Ramadhan

Ram 20849142

11<sup>th</sup> Nov 2024

- c) **Energy and Time-Consuming for Large Volumes:** Large volumes of material may be handled rather slowly and may be energy-intensive without advanced filtration systems.
- d) **Material Compatibility Issues:** Some chemicals or extreme temperatures may degrade the filter material.
- e) **Incomplete Separation:** Some filters allow small particles to pass through, while liquid retention in the residue is also a possibility that causes losses.
- f) **Maintenance Costs:** Regular maintenance and replacement of filter media add to operational expenses.
- g) **Initial Investment for Advanced Systems:** Advanced filtration systems, such as membrane filters and vacuum filtration units, can be quite expensive.

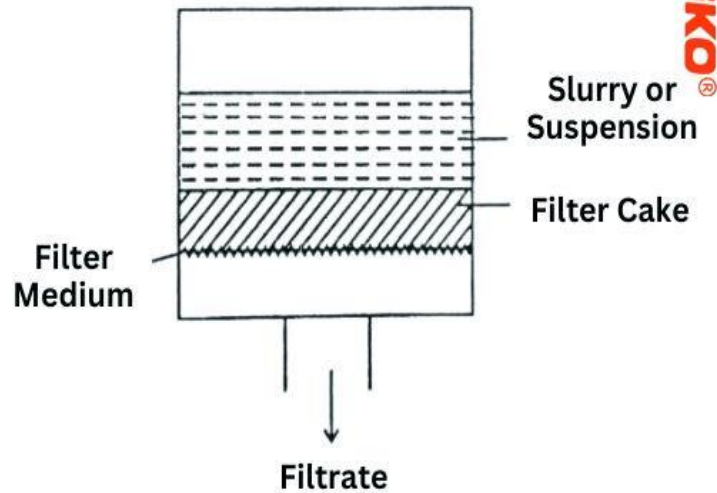
(jude envairomental technology 2024)

### **Types of filtration techniques**

#### **a) Mechanical / Straining Filtration:**

Mechanical/Straining Filtration is one of the simplest and most straightforward filtration methods. At its core, it involves passing a fluid (either liquid or gas) through a barrier or medium that stops or captures particles larger than a certain size, while allowing the fluid to pass through.

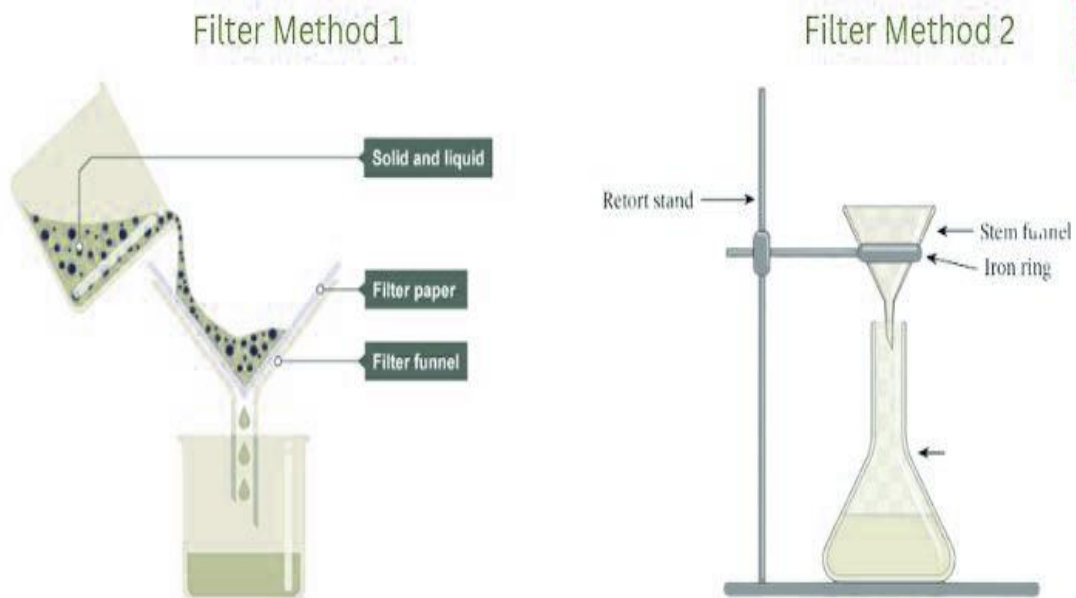
## Mechanical / Straining Filtration



### b) Gravity filtration:

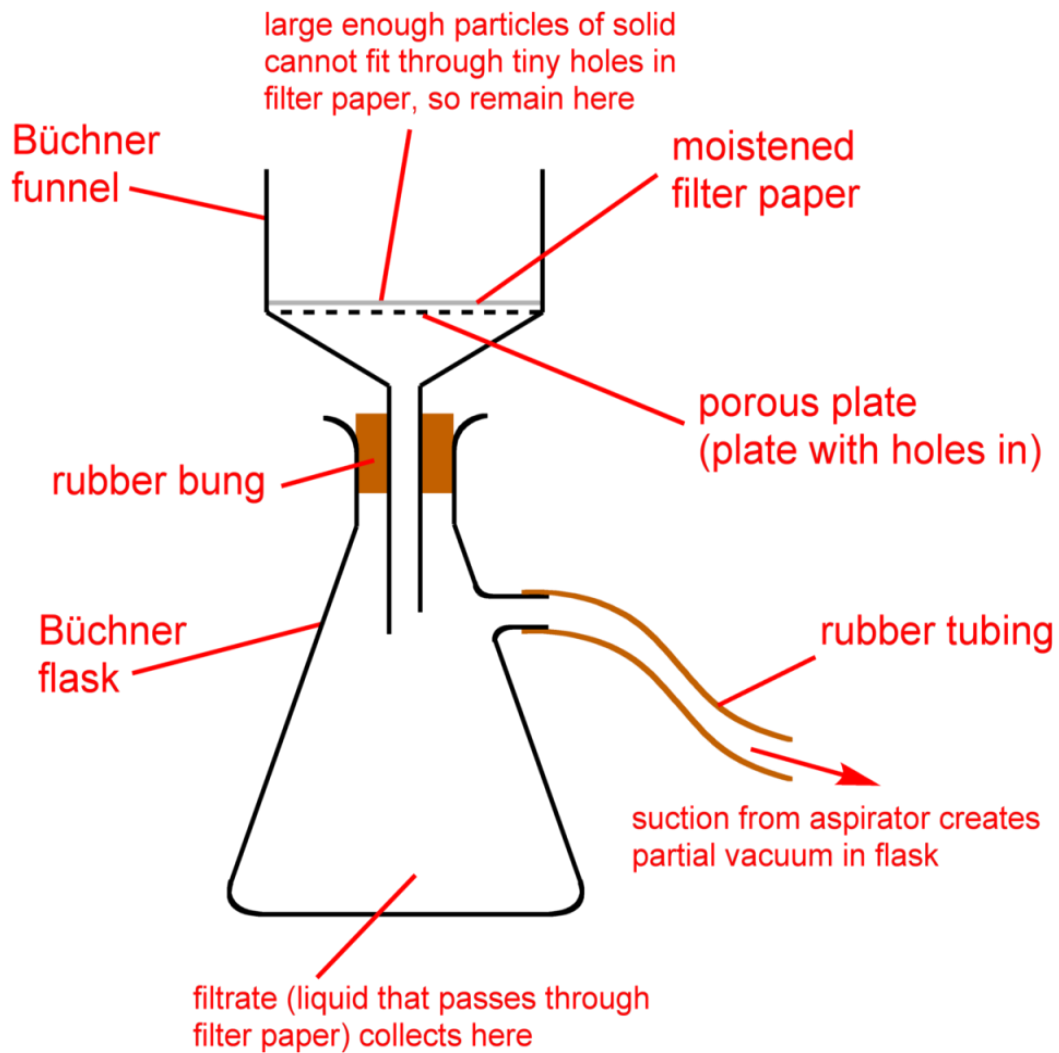
Gravity Filtration: The lab technique used to separate a solid from a liquid by the use of gravity. This is generally used in an occasion where the desired solid happens to be insoluble in a liquid, or one desires the elimination of impurities from a liquid. Two common ways of separating solids from liquids in an organic laboratory involve gravity and suction filtration techniques. Gravity filtration describes the process by which a solid-liquid mixture is allowed to flow through a funnel previously fitted with filter paper that allows the liquid to seep through while retaining the solid on the paper. Suction filtration operates similarly, except the application of a vacuum beneath the funnel draws liquid through the filter paper via suction. (nichols, 2022)

## Gravity Filtration



### c) Vacuum Filtration:

Vacuum filtration is a method of filtration involving the separation of a solid from a liquid. A pressure differential is created between the two sides of a filter paper or membrane surface to accomplish the separation. It generates a pressure difference by a vacuum pump drawing air out from the receiving chamber beneath the filter paper. As the liquid passes through the filter paper, the solid particles stay caught on the top of the paper. The filtrate then collects in the bottom of the collecting flask or is collected into another larger waste container. A reduced pressure is applied to the underside of the filter medium to pull the liquid through the medium for increased filtration rates. ([chem talk, n.d.](#))

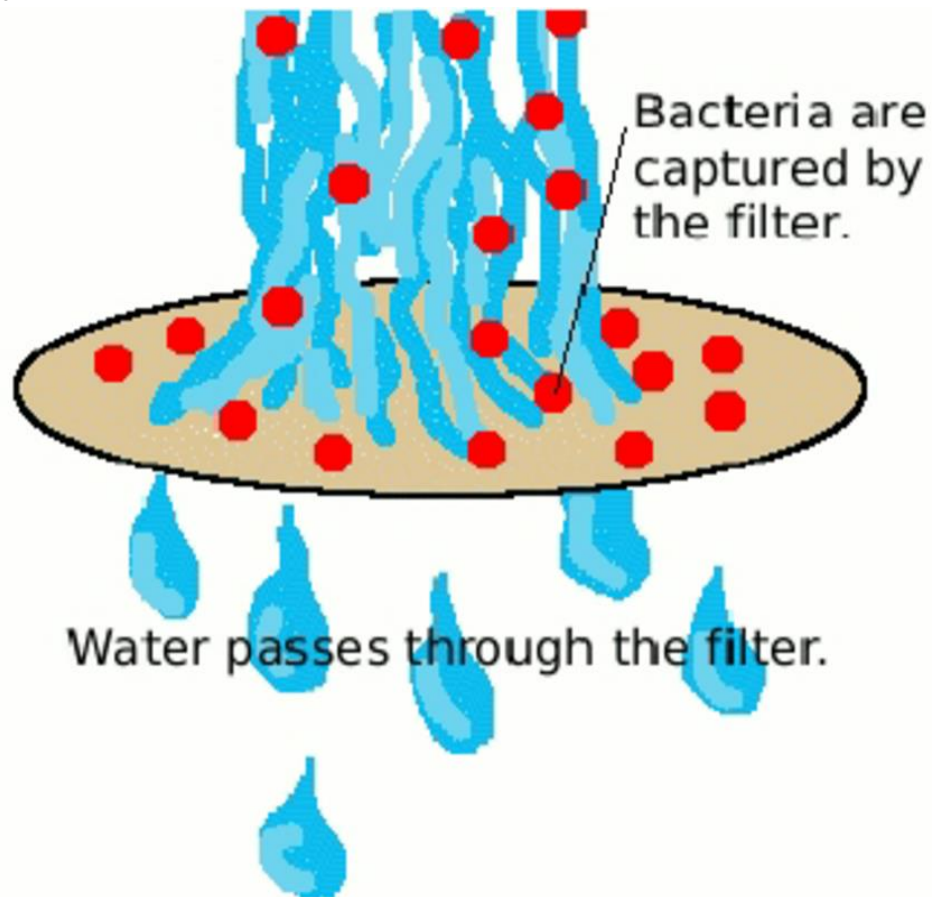


#### d) membrane filtration:

Membrane filtration is a separation technique whereby a fine-pore membrane or filter acts as a barrier. It allows the passage of smaller particles, such as water or solvents, while larger particles remain behind, like solids, bacteria, or pollutants. Applications range from water purification to food and pharmaceuticals.

The selectively permeable membrane separates molecules and particles depending on their size, allowing the small molecule to pass through while retaining the larger ones. This technique is very effective in separating oligomers of different molecular weights. It boasts of various advantages, which include not altering the structure of a compound at room temperature, ease of operation, and minimal production of laboratory waste. Some of the disadvantages include high cost of membranes and slow rates of filtration.

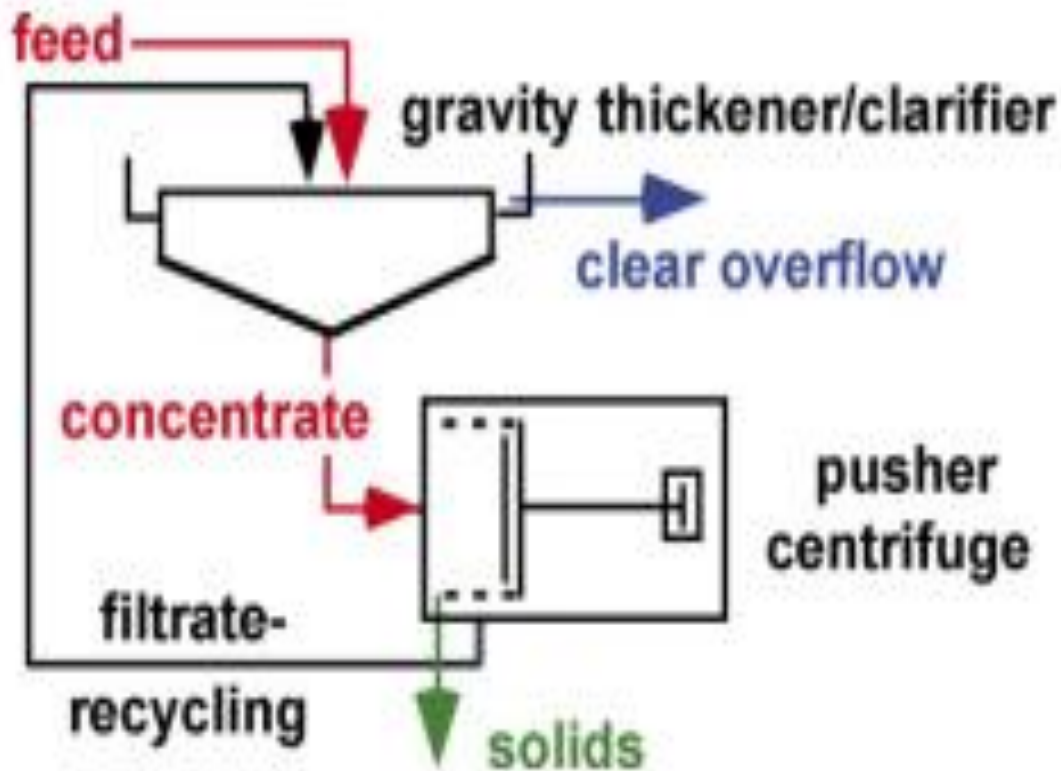
Based on the size of the pores or molecular weight cut-off, filtration membranes are classified into types like microfiltration, ultrafiltration, nanofiltration, and reverse osmosis. (S.R. Barman, 2019)



#### e) Centrifugal Filtration:

Centrifugal filtration is based on the principle that it separates the solids from liquids using the centrifugal force obtained by the high-speed spinning action. The mixture is placed inside a centrifuge, which suddenly starts its rotation at high speed. The heavy solid particles move towards the wall of the container under the effect of this force, while the lighter liquid remains closer to the centre.

This technique separates substances reliably according to differences in density. The denser the particle, the further it would move from the centre due to centrifugal force; thus, less dense particles or fluids remain at the centre. The process is carried out using a centrifuge-a device of importance for spinning mixtures and separating their components into different densities. Centrifuges are important and find wide application as one of the primary methods for separating particles from liquids. (Anlauf, 2007)



## 2. Sedimentation:

Sedimentation is a process of separating solid particles suspended in a liquid by the differences in densities. The mixture is allowed to stand for a period of time, during which gravity pulls the heavier solid particles to the bottom of the container, forming a layer called sediment, while the clearer liquid remains above it.

This is often used as a precursor to filtration and combined with other processes, such as dissolved air flotation or some filtration methods. Together, these separation processes between solids and liquids are sometimes referred to as clarification processes.

There is a range of sedimentation approaches, such as horizontal flow, radial flow, inclined plate, ballasted floc, and floc blanket sedimentation. Each is uniquely designed to make the process of settling most effective for the intended application. (Gregory R, 2007)

**Below are its advantages and disadvantages**

### **Advantages:**

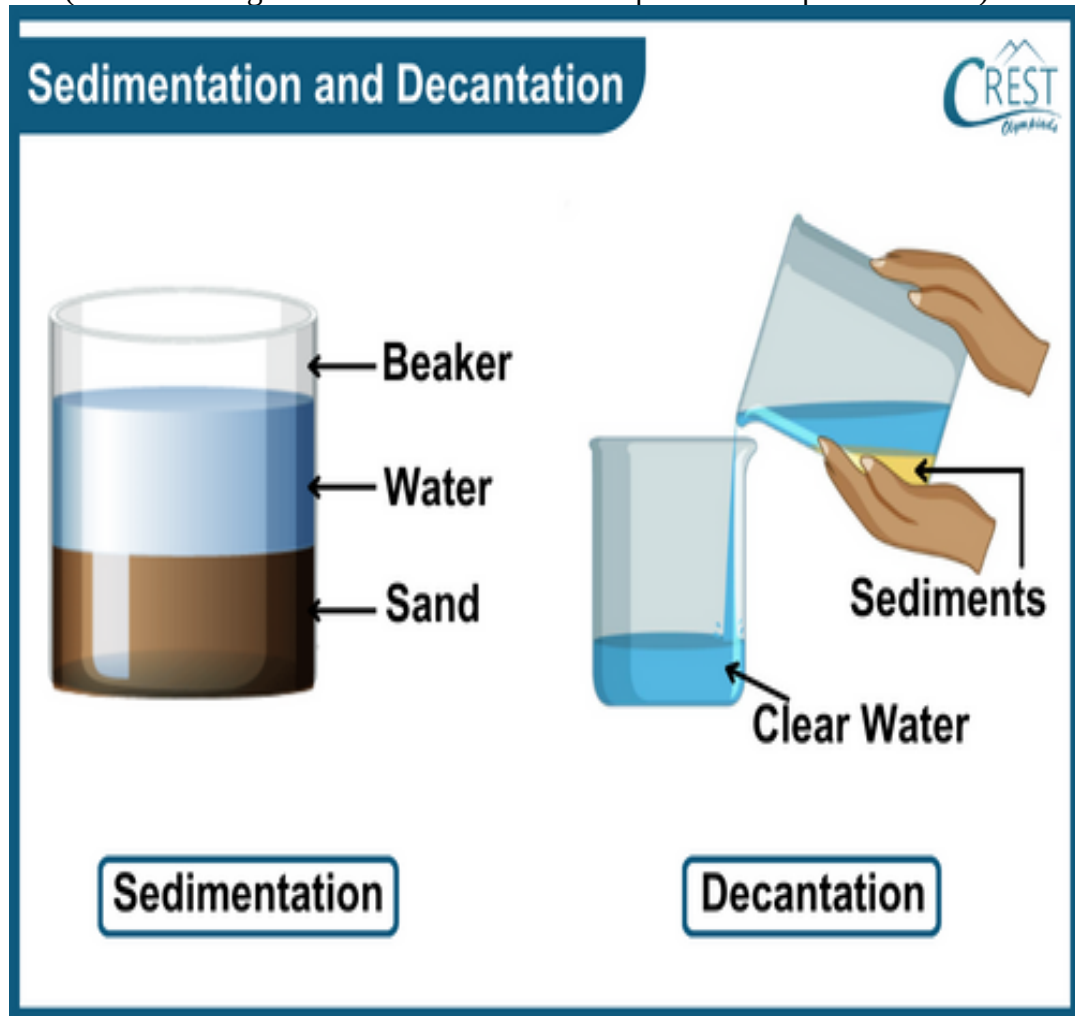
- a) **Cost-Effectiveness:** Sedimentation requires very little energy and equipment; hence, it is economical as compared to other separation methods such as filtration or centrifugation.
- b) **Simple Process:** The process is straightforward, with no complex mechanisms or machinery required.

- c) Large Volume Handling: Ideal for separating solids from large volumes of liquid, as seen in wastewater treatment and mining operations.

**Disadvantages:**

- a) Slow Process: Sedimentation may be very slow, especially for fine or low-density particles that settle slowly.
- b) Incomplete Separation: Fine particles, colloids, or lightweight materials may not settle efficiently and can remain suspended in the liquid.
- c) Large Space Requirements: Sedimentation tanks or basins require considerable space, which may not be feasible in all settings.

(Understanding the Different Methods of Liquid-Solid Separation 2024)



### 3. Hydrostatic pressure

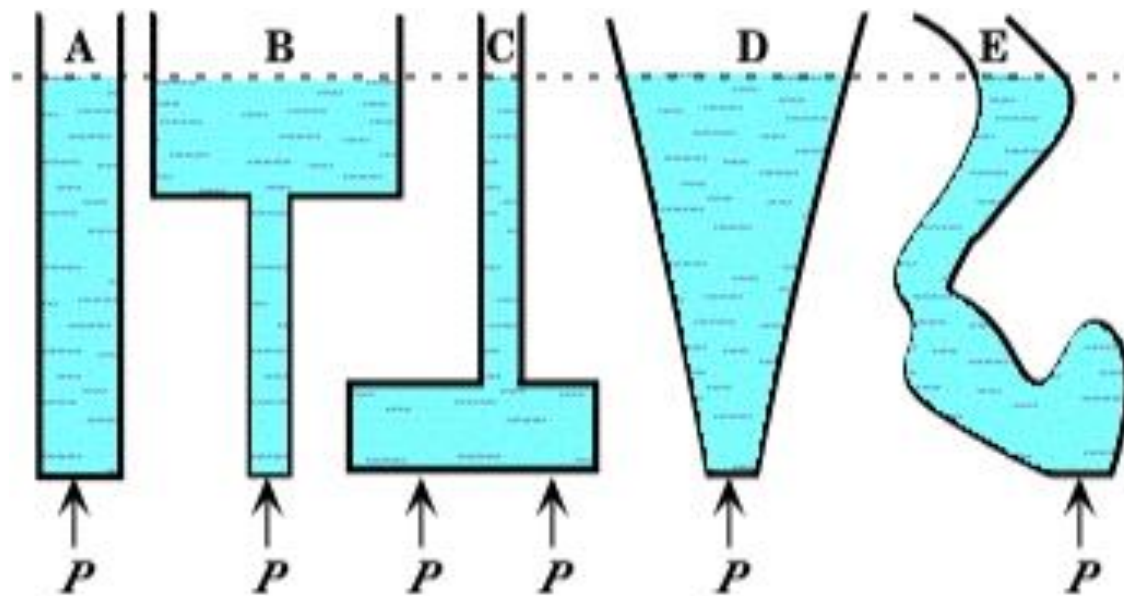
Hydraulic Pressure Separation: is a mechanical method for the separation of liquids from solids contained in any mixture, whereby high pressure applied through hydraulic systems forces the liquid to come out, leaving behind concentrated solids and extracting the liquid in purified form.

**Advantages of Mechanical Separation:**

- a) **High Efficiency:** Mechanical separation methods, such as centrifugation, are capable of rapidly and precisely separating solids and liquids, even to a fine state.
- b) **Wide Applicability:** From dense slurries to emulsions, most types of mixtures find their application in different industries.
- c) **Time-Saving:** Most mechanical systems complete the separation in a very short period of time compared to sedimentation or filtration alone.
- d) **Automated Processes:** Most mechanical systems are automated, reducing manual labour and increasing consistency.

**Disadvantages:**

- a) **High Initial Cost:** Mechanical separation equipment, such as centrifuges or presses, can be very costly initially.
  - b) **Energy Intensive:** These systems often use more energy compared to passive methods like sedimentation or simple filtration.
  - c) **Complex Maintenance:** The mechanical parts are prone to wear and tear; thus, regular maintenance and periodic replacement are needed.
  - d) **Noise and Vibration:** Mechanical equipment, especially centrifuges, may generate noise and vibrations that could necessitate soundproofing or vibration dampening.
- (Understanding the Different Methods of Liquid-Solid Separation 2024)



**4. Flotation:**

Flotation is a separating method that is usually based on the physical and chemical properties of materials, essentially on its capability to adhere to air bubbles. The process works by introducing gas bubbles into a mixture, causing hydrophobic particles or particles that have been made hydrophobic, to attach to the bubbles. These then float through the liquid towards its surface moving against the force of gravity.

Flotation can be performed using a number of different bubble generation methods. These fall broadly into two categories: dispersed-air flotation-often including electro-flotation-or

froth flotation, which is the method used in mineral processing, and dissolved-air flotation (DAF), based on Henry's law. (Kyzas, 2018)

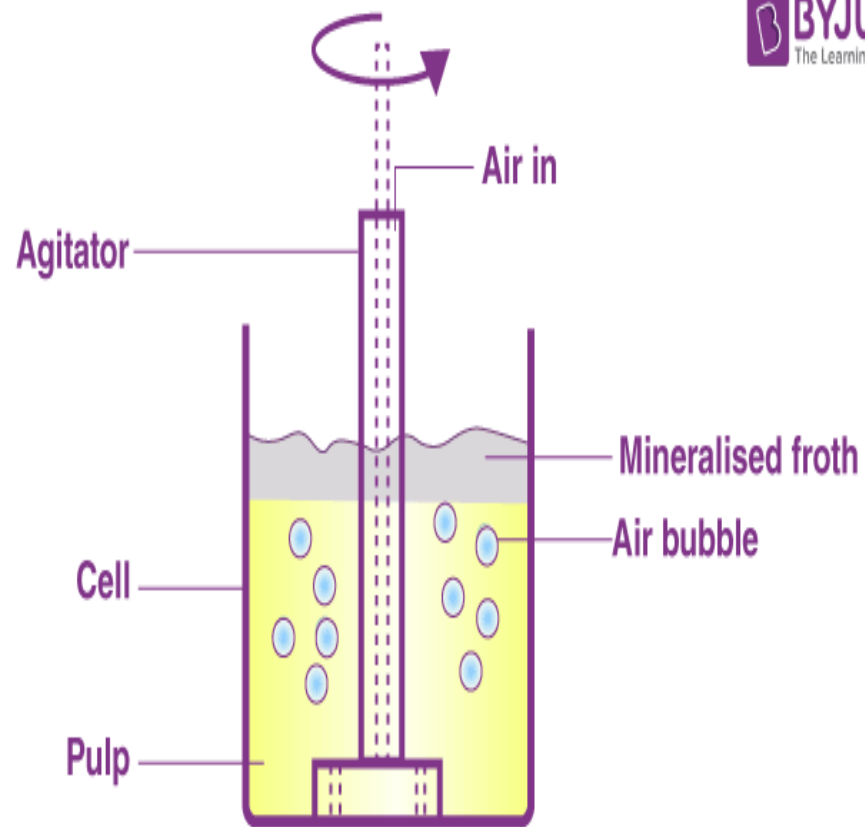
**Advantages of flotation:**

- a) **Effective for Fine Particles:** Flotation is effective in the separation of fine particles, which may not settle effectively by sedimentation.
- b) **Selective Separation:** By modifying the surface chemistry of particles with reagents, flotation enables the selective separation of desired materials, such as minerals in ore processing.
- c) **Recovery of Valuable Materials:** It makes possible the recovery of values, like metals or fibres, from mixtures.
- d) **High Throughput:** It allows large volumes to be handled in relatively short periods, which makes flotation very suitable for industrial applications.

**Disadvantages of flotation:**

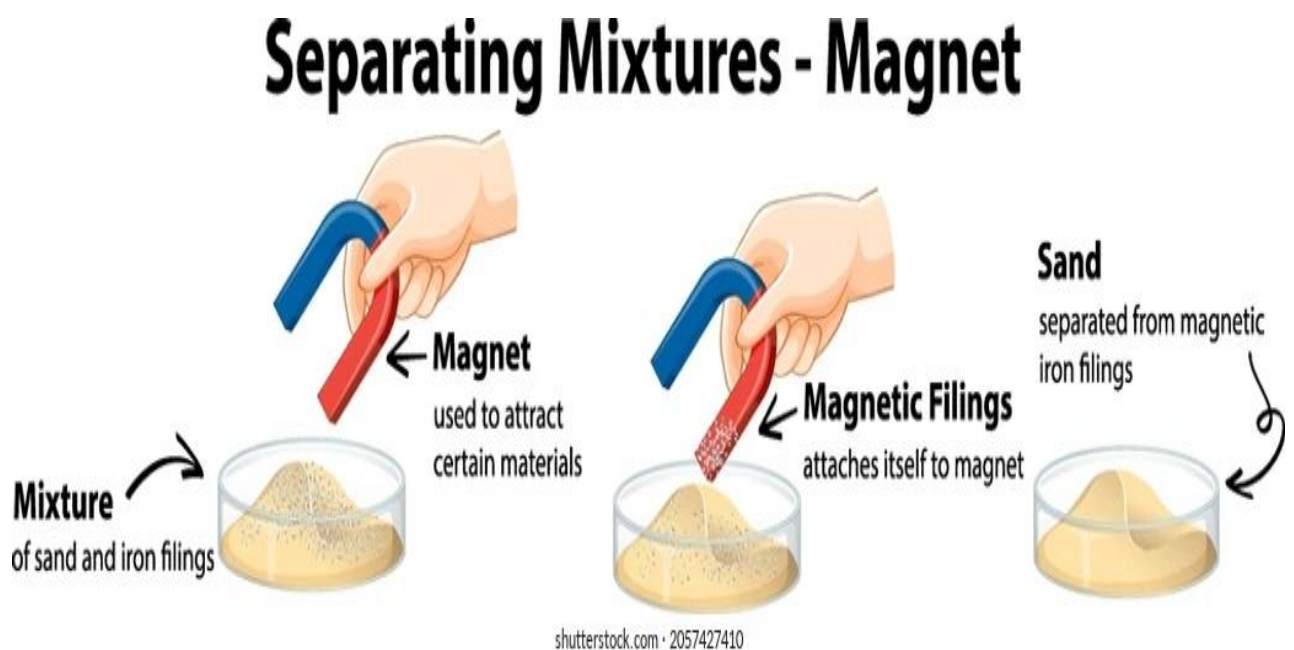
- a) **Complex Process:** Operating parameters, such as pH and reagent dosing and bubble size, must be carefully controlled to effect efficient separation.
- b) **High Operating Costs:** Operational costs may increase due to the use of reagents and energy for aeration or agitation.
- c) **Specialized Equipment:** Specialized equipment, such as flotation cells, may be required, which is costly to install and maintain.
- d) **Limited to Surface-Active Materials:** It works best for particles that can be made hydrophobic, thus limiting its application for certain solids.

(Understanding the Different Methods of Liquid-Solid Separation 2024)



## 5. Magnetic separation:

Magnetic separation is widely used in many industries to separate magnetic materials from non-magnetic impurities. (wikipedia, 2024)



**Types of Magnetic Separator:**

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11<sup>th</sup> Nov 2024

**I. Magnetic Drum Separators:**

Cylindrical magnets inside rotating drums.

Valuable for continuous separations of huge volumes of materials.

**II. Overbend Magnetic Separators:**

Suspended magnets remove ferrous material from conveyor belts.

Magnetic Pulley Separators:

A part of a conveyor belt system used to separate iron contaminants.

**III. High-Gradient Magnetic Separators (HGMS):**

Very strong magnetic fields are used for separating fine particles.

Applied in mineral processing and purification tasks.

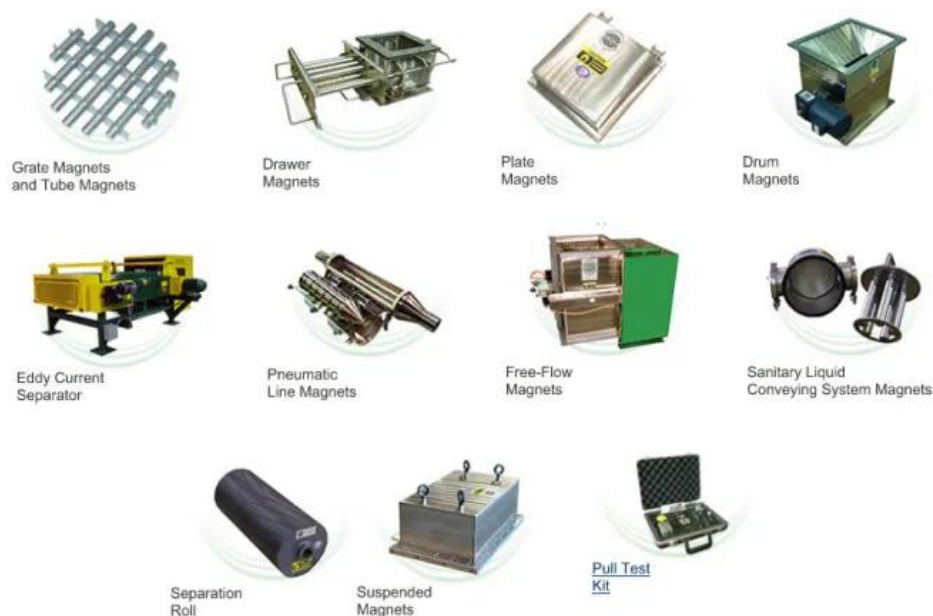
**IV. Wet Magnetic Separators:**

Used when separating magnetic materials from liquid suspensions.

**V. Magnetic Filters:**

Remove small ferrous contaminants from fluids.

(JXSC, 2019)



**Advantages of Magnetic Separation:**

- a) **Selective Separation:** It effectively separates magnetic solids, such as iron and steel particles, from non-magnetic components, giving a high degree of selectivity.
- b) **Non-Chemical Process:** Magnetic separation does not use chemicals; hence, it is an environmentally friendly and cost-effective technique.
- c) **Efficient and Fast:** Large volumes can be handled in a very short time, hence suitable for high-throughput operations.
- d) **Low Operating Cost:** The cost of operation is low after the initial investment, since no consumables, such as chemicals, are involved in the process.
- e) **Reusable Materials:** The magnetic material is often recoverable and re-usable, which again adds to sustainability by reducing waste.

- f) Easy to Maintain: Most magnetic separators have fewer moving parts, reducing the intensity and costs associated with maintenance.

**Disadvantages of Magnetic Separation:**

- a) Limited to Magnetic Materials: Only works for materials with magnetic properties, so it cannot separate non-magnetic solids from liquids or other non-magnetic solids.
- b) High Initial Cost: Equipment such as high-gradient magnetic separators or drum separators can be very costly to buy and install.
- c) Field Strength Limitations: In the case of weakly magnetic materials, a very strong magnetic field can be required, which may raise equipment complexity and electrical consumption.
- d) Not Effective for Fine or Colloidal Particles: The process may not effectively capture very small or fine magnetic particles, especially in wet separation processes.
- e) Energy Consumption: High-intensity magnetic separators consume a high amount of energy, hence increasing operational costs in certain applications.
- f) Specialized Design Requirements: Certain applications may require customized designs to achieve effective separation, which adds to the cost and complexity of designing such systems.  
(neomagnets 2024)

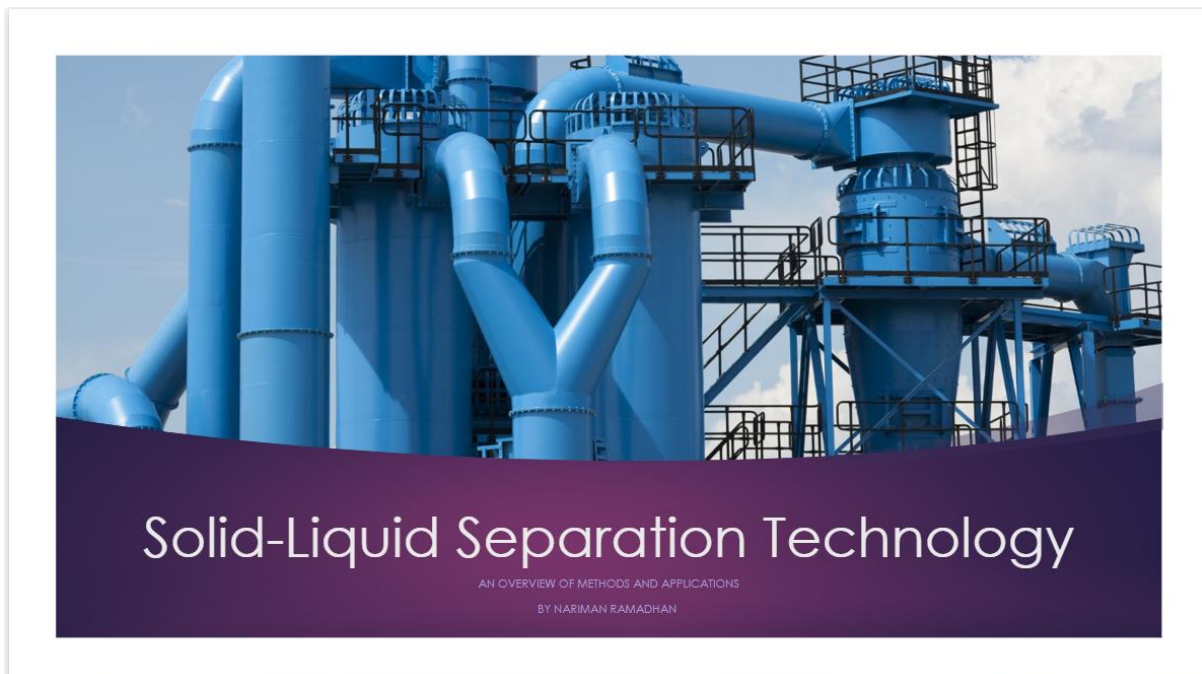
## Conclusion:

The document intends to provide a structured overview of the solid-liquid separation technologies in regard to their vital roles across various industrial and scientific fields. It gives an in-depth understanding of the principles of the operation, leading from basic techniques such as filtration, sedimentation, hydrostatic pressure, flotation, and magnetic separation, among others. Each technique, when related to efficiency and material nature, has different advantages; therefore, it is suitable in a situation according to the particular nature.

The incorporation of visual aids significantly improves understanding, allowing readers to comprehend the practical elements of these technologies. This publication acts as an important resource for both professionals and researchers, facilitating access to critical information within the discipline.

Future research could expand on the foundational work of studying advanced separation techniques, automation of such processes, or even the environmental impact of such processes. The report helps to advance the technology and inform decisions in related industries by developing an improved understanding of solid-liquid separation.

## Power point presentation

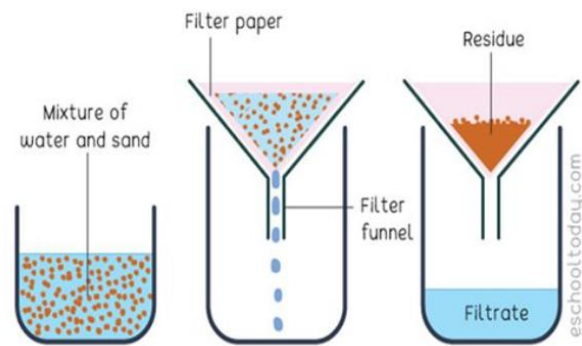


## Introduction

- ▶ Solid-liquid separation is essential in industries such as mining, pharmaceuticals, and wastewater treatment.
- ▶ Methods include filtration, sedimentation, centrifugation, and membrane processes.
- ▶ Selection depends on particle size, concentration, and required separation efficiency.
- ▶ Efficient separation improves product quality and reduces environmental impact.

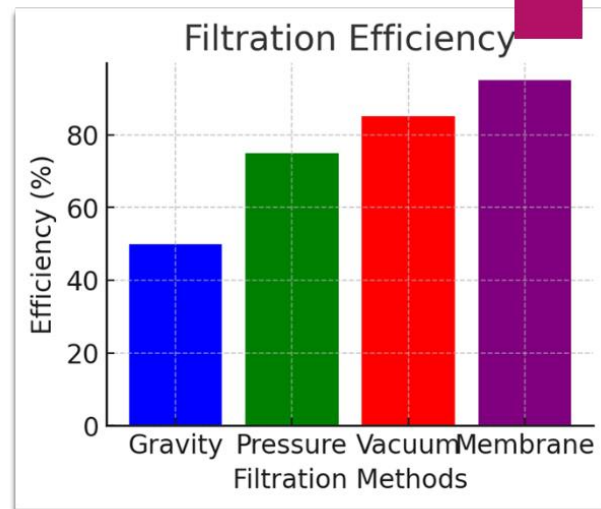
## Common Techniques

- ▶ **Filtration:** is a process that separates solids from liquids by passing the mixture through a material that lets the liquid go through while keeping the solid particles behind.



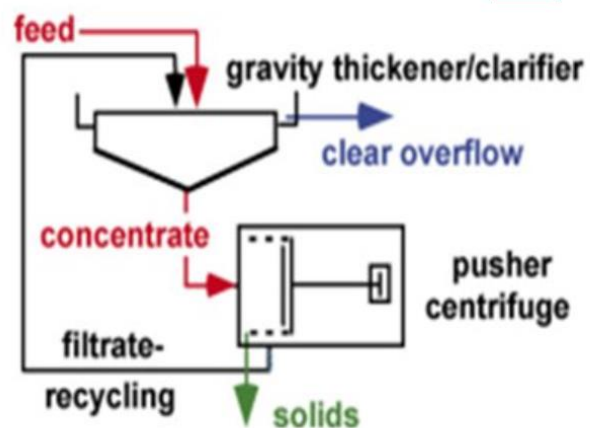
## Filtration Methods

- ▶ • Gravity filtration: Simple, low-cost for coarse particles.
- ▶ • Pressure filtration: Uses external force, e.g., filter presses.
- ▶ • Vacuum filtration: Enhances separation with reduced pressure.
- ▶ • Membrane filtration: Effective for fine particles and dissolved solids.



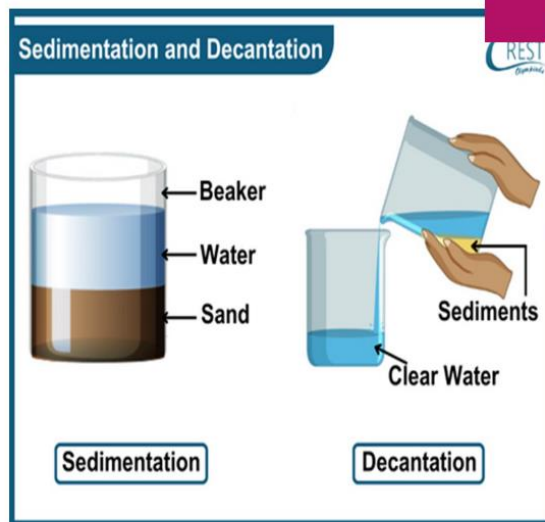
## Centrifugation

- Centrifugation: Uses rotational force to separate by density.
- Common in medical and chemical applications.



## Sedimentation

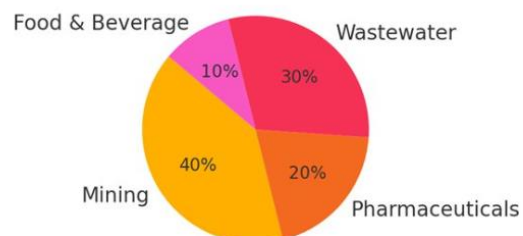
- Sedimentation: Particles settle due to gravity.
- Used in clarifiers and thickeners for large-scale treatment.



## Industrial Applications

- Mining: Separates valuable minerals from slurry.
- Pharmaceuticals: Ensures purity of drug compounds.
- Wastewater treatment: Removes solids to improve water quality.
- Food & Beverage: Used in juice clarification and dairy processing.

Usage of Solid-Liquid Separation by Industry



## Conclusion

Solid-liquid filtration and separation technology are very important in several industries, such as the purification of liquids, recovering values and achieving desired product specification.

Advances in membrane and centrifugal technologies improve efficiency.

Any quotation?

Thank you