A

Seminar report

On

Diffusion

Submitted in partial fulfillment of the requirement for the award of degree
of Bachelor of Technology in Mechanical

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Acknowledgement

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Secondly, I would like to thank my parents who patiently helped me as i went through my work and helped to modify and eliminate some of the irrelevant or un-necessary stuffs.

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Preface

I have made this report file on the topic **Diffusion**; I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to ……..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

Introduction

Diffusion-weighted magnetic resonance imaging (MRI) has become an established method for the noninvasive evaluation of cerebral ischemia in both animal models and humans. Although the biophysical mechanism(s) underlying apparent diffusion coefficient (ADC) reduction remain incompletely understood, diffusion-weighted imaging (DWI) is widely recognized for its ability to noninvasively detect ischemic brain injury within minutes after its onset, whereas other

conventional imaging techniques (such as T1- and T2-weighted MRI and computed tomography [CT]) fail to detect such injury for many hours.

Brain tissues with cerebral perfusion deficits below a critical threshold experience metabolic energy failure, membrane depolarization, and subsequent cellular swelling (cytotoxic edema).These changes precipitate a reduction in the ADC of brain water and are manifested as a hyperintense region on DWI During the first few minutes in animal models to a few hours in human stroke (*ie*, the acute phase), the anatomic area defined by DWI is initially smaller than the area of perfusion deficit. However, most of this DWI-defined ischemic region expands and eventually coincides with the abnormal area defined by perfusion-weighted imaging (PWI). The difference in the abnormal region defined by the PWI and DWI in the acute phase of stroke, commonly referred to as the "perfusion-diffusion" mismatch, was suggested to be potentially salvageable ischemic tissue Other MRI parameters, such as proton density (M0) and T1 and T2 relaxation times, are generally unaffected early after stroke onset and only begin to change with the advent of vasogenic edema (typically > 6 hours).

The perfusion-diffusion mismatch region is presumed to approximate the ischemic penumbra, which is a region of moderately ischemic tissue with diminished cerebral blood flow (CBF) and impaired electrical activity but preserved cellular metabolism. The transition from reversible to irreversible injury is complex and highly dependent on the duration and severity of ischemia, and as such, different areas of the penumbra could have variable outcomes. Re-establishing tissue perfusion and/or administering neuroprotective drugs in a timely fashion are expected to salvage some ischemic tissues To potentially help to expand the time window for thrombolytic therapy and to provide individualized diagnosis and treatment, it will likely be important to have an imaging-based identification of the "tissue signature" and "clock window" of ischemic tissue in order to achieve the maximum benefit and to avoid the occurrence of a devastating intraparenchymal hemorrhage.

What is Diffusion?

Systems are often not in equilibrium; that is, the movement of materials into and out of the system is not equal. Diffusion is a movement in which the net direction of movement is from an area of high concentration to an area of low concentration. When equilibrium is reached, the concentration on both sides

should be equal. However, it is important to know that even at equilibrium, the movement between the two sides still occurs, but the rate of movement is the same. Another important thing to keep in mind is that diffusion is a passive process so no energy is used.

Application

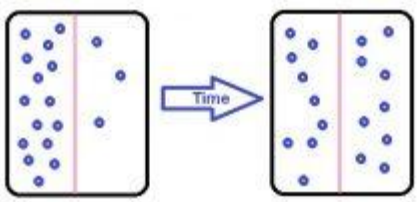
- Release of drugs from dosage forms diffusion controlled like sustained and controlled release products.
- Molecular weight of polymers can be estimated from diffusion process.
- The transport of drugs from gastrointestinal tract, skin can be predicted from principal of diffusion.
- Processes such as dialysis, micro filtration, ultra filtration, hemodialysis, osmosis use the principal of diffusion.
- Diffusion of drugs into tissues and excretion through kidney can be estimated through diffusion studies.

Types of Diffusion

Diffusion can either be simple diffusion and be facilitated by another molecule

Simple Diffusion

Simple diffusion is merely the movement of molecules along their concentration gradient without the direct involvement of any other molecules. It can involve either the spreading of a material through a medium or the transport of a particle across a membrane. All the examples given above were instances of simple diffusion.

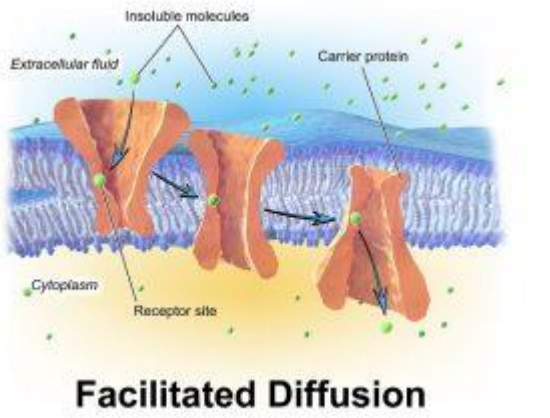


The image is a simple representation of the diffusion of one particle in another medium.

Simple diffusion is relevant in chemical reactions, in many physical phenomena, and can even influence global weather patterns and geological events. In most biological systems, diffusion occurs across a semi-permeable membrane made of a lipid bilayer. The membrane has pores and openings to allow the passage of specific molecules.

Facilitated Diffusion

On the other hand, facilitated diffusion, as the term indicates, requires the presence of another molecule (the facilitator) in order for diffusion to occur. Facilitated diffusion is necessary for the movement of large or polar molecules across the hydrophobic lipid bilayer. Facilitated diffusion is necessary for the biochemical processes of every cell since there is communication between various subcellular organelles. As an example, while gases and small molecules like methane or water can diffuse freely across a plasma membrane, larger charged molecules like carbohydrates or nucleic acids need the help of transmembrane proteins forming pores or channels.



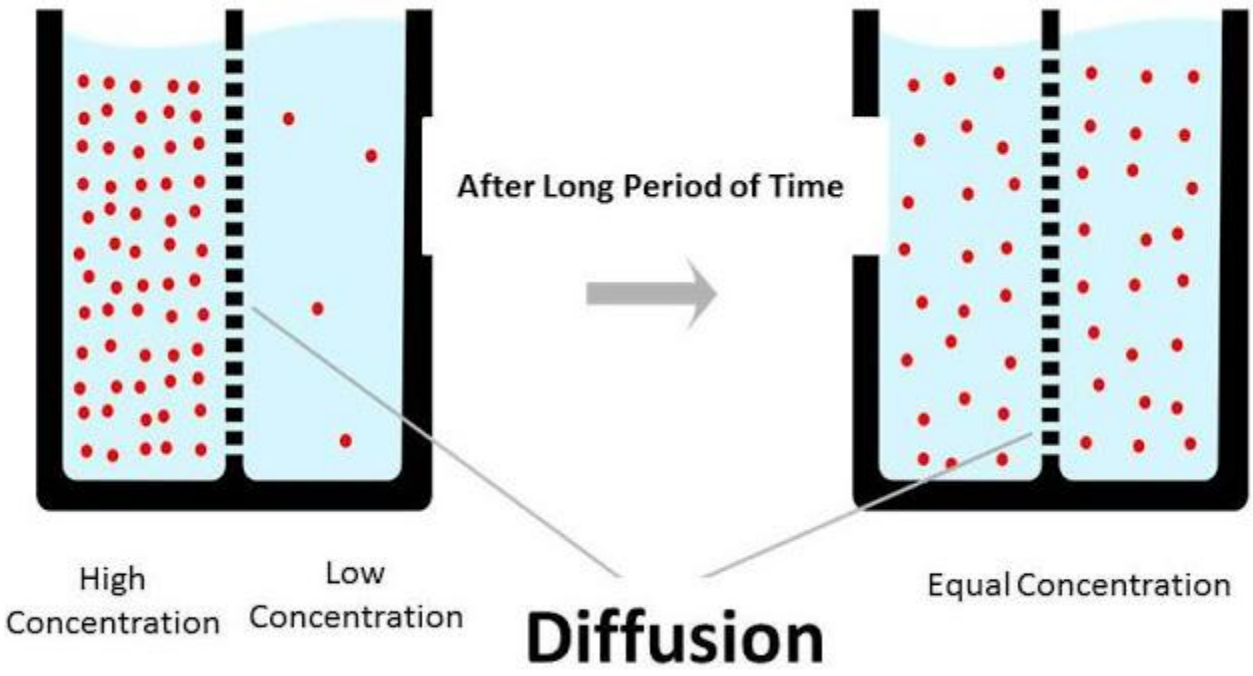
Facilitated Diffusion

The image shows the movement of an insoluble molecule from the extracellular space towards the cytoplasm.

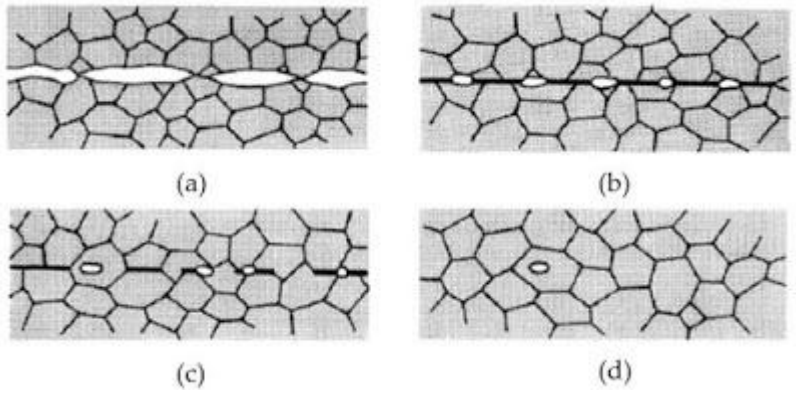
Since they are relatively large openings in the plasma membrane, these integral membrane proteins also have high specificity. For instance, the channel protein that transports potassium ions has a much higher affinity for that ion than a very similar sodium ion, with nearly the same size and charge.

Principle and Working

This process works on basic principle of diffusion. Diffusion means movement of molecules or atoms from high concentration region to low concentration region. This is fundamental principle of diffusion welding. In this welding process both the welding plates are placed one over other in high pressure and temperature for a long period of time. This high pressure force starts diffusion between interface surfaces. This diffusion can be accelerated by the application of high temperature. This temperature does not melt the welding plates. The temperature range is about 50-60% of melting temperature. This whole process takes place in vacuum or in inert environment which protects the welding plates form oxidation.



The working of diffusion bonding can be summarized as follow.



- First both the welding plate surfaces prepared for welding. In this process, both the interface surfaces made equally flat which is basic requirement of diffusion process. The interface surfaces should be machined, cleaned and polished well which remove all chemical contaminants from the surface. Any contaminant particle can be reduced diffusion between welding plates.
- Now both the plates are clamped and placed one over another. This assembly placed into a vacuum chamber or in a inert environment. This protects the welding surface from oxidation.
- A high pressure and temperature applied on this assembly to start diffusion. The temperature applied by the furnace heating or electric resistance heating. The high pressure is applied by a hydraulic press, dead weight or by the differential gas pressure. This conditions are maintained for a long duration of time for proper diffusion.
- At the starting stage of this process, local deformation at the interface surface due to creep and yield take place. Now the diffusion takes place which form a interface boundary.
- After a long period of time, both the plates properly diffused into one another which makes a strong joint. The interface boundary disappear which form a clean joint. This joint has same properties or strength as the base material.

Advantages

- The joint have same mechanical and physical properties as parent material.
- This process produces clean joint which is free from interface discontinuity and porosity.
- Both similar and dissimilar material can be joint by diffusion bonding process.
- It provides good dimension tolerance. So it is used to make precision components.
- Low running cost.
- It is simple in working.
- It does not use filler material, flux etc. which are used in arc welding process.

Disadvantages

- High initial or setup cost.
- It is time consuming process. It takes more time compare to other welding process.
- Surface preparations of welding plates are more critical and difficult.
- Size of the weld is limited according to equipment available.
- This process is not suitable for mass production.
- Highly depend on welding parameters like surface finish, welding material, temperature, pressure etc.

Reference

- ☐ www.google.com
- ☐ www.wikipedia.com
- ☐ www.studymafia.org