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Formulation and Evaluation of Bilayer Tablet of Furosemide and Ginger

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Abstract: *Drugs that increase urine flow are known as diuretics. Loop diuretics are prescribed for the management of edema as well as diseases linked to fluid excess, such as cirrhosis or nephrotic syndrome, hypertension, and heart failure. using diuretics, which are medications that lessen the body's retention of fluid and, as a result, lower the consumption of salt in food. reducing the amount of fluids you consume. Drugs called diuretics aid in lowering the body's fluid accumulation. The kidneys are assisted by most diuretics in eliminating salts and particles from urine. This causes less fluid to pass through the veins. and vascular structures. One member of the medication class referred to as loop diuretics, or water pills, is furosemide. Natural herbal medicines are being considered more and more all over the world for the prevention and treatment of various ailments. The biological advantages of gingerols include their anti-inflammatory, anti-microbial, antioxidant, and anti-cancer qualities.*

Keywords: Furosemide, Diuretics, Bilayered tablet, Gingerol

I. INTRODUCTION

Kidneys provide the vital function of being an essential organ because it cleanses the blood of waste and poisons and controls a host of other crucial processes, including as preserving bodily fluids. The body is unable to eliminate extra urine and waste when kidney impairment takes place from the body and blood electrolytes (such magnesium and potassium) will all rise. Average life span compared to thirty years earlier has grown worldwide, resulting in a greater number of elderly people with more illnesses. They take numerous prescriptions, are exposed to more, and have a higher incidence of lifestyle disorders like diabetes and cardiovascular disease. procedures that could impair renal function, both therapeutic and diagnostic. One major contributing factor to both acute and chronic renal failure is drug-induced kidney disease. illness in modern clinical practice. Due to the growing number of medications available and their ease of use, the frequency of drug-induced nephrotoxicity has been rising.

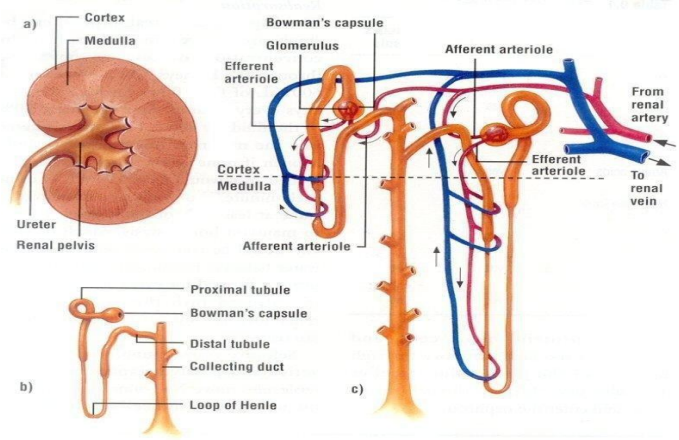

Fig 3. Diuretics

Accessibility of over-the-counter/medicationsanti-inflammatory non-steroidal medications (NSAIDs). The primary medications that cause kidney injury include contrast agents, angiotensin converting enzyme inhibitors (ACEI), antibiotics, and nonsteroidal anti-inflammatory drugs (NSAIDs). In an Indian study, 20% of instances of acute renal failure (ARF) were caused by drugs, with aminoglycosides accounting for 40% of all cases.Many ailments, including

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diabetes and hypertension, were brought about by changing lifestyles and are a significant cause of kidney damage. Over 15 million people globally are on dialysis or have a functioning transplant, and the frequency of kidney disease has risen over the past 15 years, according to Med India. Ninety percent of the 7.85 million or so individuals with chronic renal failure in India cannot afford the care that is required for them. Reproductive disorders are therefore becoming more commonplace worldwide. Acute renal failure, chronic intestinal nephritis, and nephritic conditions can all be caused by different medicinal drugs negatively affecting the kidney.

Toxic wastes that have accumulated in the blood must be eliminated by the kidneys. For people with renal disease, eating a nutrient- rich diet is crucial to maintaining and enhancing kidney health. Ginger is a great source of vitamins and minerals, including C and magnesium. For those who have kidney stones, drinking ginger tea can also be beneficial as it may help dissolve the stones so they can be expelled through the urine. As a result of ginger's anti-inflammatory qualities, consuming ginger tea helps support the kidneys' defense against bacterial infections and so improve kidney function.

Fig 2. Ginger

Mechanism of furosemide bilayer tablet :

Furosemide bilayer tablets generally have two layers: an immediate-release layer and a sustained -release layer. The current system releases furosemide rapidly after ingestion for a quick start. At the same time, the release mechanism gradually releases the drug over a longer period of time to maintain the drug level in the blood. This two-layer design allows for greater control and longer medication use, optimizing treatment while reducing side effects. The specific process of how each layer achieves this release may involve a variety of technologies such as matrix systems, osmotic pumps, or layer technologies such as enteric coatings.

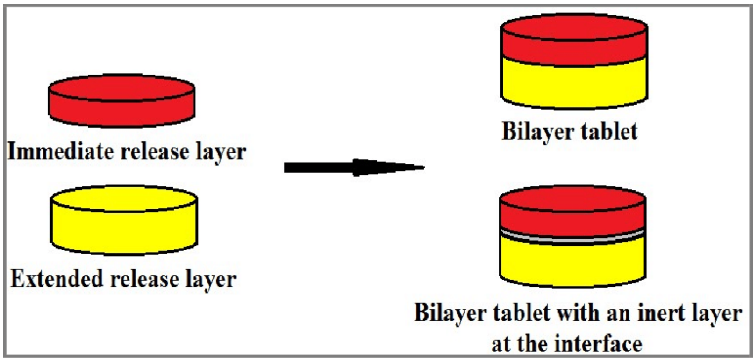

Fig 3. Bilayered Tablet

Furosemide is a potent loop diuretic that increases renal excretion of sodium and water by inhibiting reabsorption in the proximal and distal tubules and the loop of Henle. It acts directly on nephron cells and indirectly changes the content of the renal filtrate.It aims to achieve synergistic effects by affecting various parts of the nephron.

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Fig 4. Ginger

Material :
Furosemide API, and other ingredients included Lactose monohydrate, Sodium starch glycolate, Maize starch, Magnesium stearate, Herbal extract (gingerol)

Methods :
Single sided tablet press
Double sided tablet press
Bilayerd tablet press with displacement monitoring

Single sided tablet press
The most basic design consists of a single sided press that has the double feeder's two chamber apart. The two distinct layers of the tablets are produced by forcing or gravity-feeding distinct powers into each chamber. First, the layer power and then the second layer powder are put into the die as it passes beneath the feeder. Next, in one or two processes the entire tablet is crushed.

Fig 5. Single Sided tablet press

Double sided tablet press
Compression force is used by the majority of double-sided tablet presses with automated production control to track and manage tablet weight. The control system measures the effective peak compression force applied to each tablet or

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layer at the point of maximum compression of the layer. The control system uses this measured peak compression force as a signal to reject tablets that are out of specification and adjust the die fill depth when necessary.

Fig 6. Double Sided tablet Press

Bilayerd tablet press with displacement monitoring :

The displacement pill weight control principle differs fundamentally from the compression force -based principle. The control system sensitivity when sensing displacement is dependent on the applied pre-compression force rather than the weight of the tablet.

Fig 7. Bilayerd tablet press with displacement monitoring

Advantages of bilayered tablet:

- They allow for the simultaneous or sequential release of two different rugs, enhancing therapeutic outcomes.
- Bilayer tablets can combine drugs with varying solubilities or stability profiles, enhancing formulation of drugs that would otherwise be incompatible.
- Each layer can contain a different dose, allowing for tailored dosing regimens or combination therapies.
- The layers can be designed to release drugs at different rates, such as immediate release and sustained release, for optimal therapeutic effect.
- Combining multiple medications into a single dosage form can simplify dosing schedules and improve patient adherence to treatment.

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Procedure for preparation

The components of the drug, namely furosemide, polymers and other excipients, were accurately weighed. Furosemide was thoroughly mixed with mannitol onparchment paper. The remaining ingredients, excluding the lubricant, were mixed in order from lowest weight to highest weight, then placed in an expanded plastic bag and mixed for 10 minutes. The lubricant was then added and stirring wascontinued for an additional 2 minutes. The mixture thus formed was pre-compressed in a 10-station rotary tablet punching machine at a pressure of 0.5 tons and a turret speed of 2 rpm to produce single-layer flat tablets with a diameter of 7 mm. Next, 50 mg of ethylcellulose powder was added and final tableting was performed at a pressure of 3.5 tons and a turret speed of 2 rpm to obtain a two-layer tablet.

Evaluation of bilayer tablet

Pre-compressione valuation:

Particle size distribution

The procedure of sieving is used to measure the particle size distribution

Angle of repose

The following formula was used to determine the angle of repose and estimate the diameter of the powder cone.

0 = tan()

Where, ‘r’and ‘h’ denote the powder of cone's radius and height respectively.

Density

The following formula was used to determine and calculate the bulk density (BD) and tapped density (TD).

Bulk Density= weight of powder/Bulk volume

Tapped Density = weight of powder/Tapped volume

Compressibility

Carr’s Compressibility index was used to calculate the disintegrates Compressibility index

Carr’s index(%)= (TD-BD)/TD×100

Hausnser’sratio

It is calculate by the formula,

Hausnser’sratio=TD÷BD

Post-compression parameters

General Appearance

Customer approval of a tablet is largely dependent on its overall design, visual identity, and "elegance". Included are the tablet's dimensions, form, colour, taste, consistency, surface roughness, physical defects, and the presence or lack of an aroma.

Size and Shape

The size and Shape of the tablet can be dimensionsal described, monitored and controlled.

Thickness

The thickness of tablet is important for the Appearance of the packaging material and the production of the number some filling equipment uses of the thickness of the tablet as the calculation method. Take ten tablets and record their thickness using a micrometer . Generally thickness should be between 30%-50% of tablet dimensions.

Weight Variation

Follow the standard procedure described in the official manual.

Friability

Friction and impact are the forces that most commonly cause the tablet to crumble, its cover to close, or to break. Friability testing is closely related to tablet hardness and is designed to evaluate the tablet's ability to resist damage during packaging, handling and shipping. It is usually measured using a Roche friability tester. Wear loss is a measure

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of tablet friability. The value is expressed as a percentage. During friability testing, a maximum loss not exceeding 1% of the weight of the test tablet is generally considered acceptable and any breakage is considered reasonable. Or crushed medicine is not collected. Normally, friability values are not calculated when capping occurs. Thicker tablet are less prone to capping, while thinner tablets with wider lines usually show capping, thus indicating that thicker tablets reduce stress.

Hardness

The harder the tablet, the more resistant it is to capping, abrasion, or breakage during handling, storage, and transit before to use. In the middle of the 1930s, Monsanto produced and released the compact and lightweight hardness tester. The diametrically applied force needed to shatter the pill is measured by the Strong-Cobb Pfizer and Schleuniger equipment, which was later introduced. If the meet the dissolving standards tablet is too soft, it might not be able to handle handling during further processing, like coating, packing, and shipping; if it is too hard, it might not dissolve in the time needed to.

Disintegration

Disintegration test was performed according to the PH. Where six tablets, and distilled water as the medium. The time required for complete disintegration of each tablet was recorded individually.

In-vitro Dissolution studies

Dissolution test was performed on apparatus 2 (paddle method,50 rpm). At predetermined time intervals (5,10,15,20,30,45,60 min) sample (2ml) were withdrawn and replaced with fresh dissolution medium. The samples were filtered through 0.45um membrane filter and analyzed on UV spectrophotometer (Shimadzu 1800) at 276 nm to determine drug content.

II. CONCLUSION

In conclusion, the development of improved diuretic formulations for clinical use holds significant promise for enhancing patient outcomes and treatment efficacy in conditions such as hypertension, heart failure, and edema. By addressing key implications such as enhanced patient compliance, minimized adverse effects, tailored release profiles, targeted drug delivery, combination therapies, improved safety profiles, cost-effectiveness, and regulatory considerations, these advancements have the potential to revolutionize diuretic therapy.Through innovative formulation strategies, including sustained release formulations, targeted delivery systems, and combination therapies, developers can optimize drug efficacy while minimizing side effects, improving safety, and reducing the burden of treatment for patients. Moreover, the cost-effectiveness of these formulations can lead to better resource utilization and healthcare savings.

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