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"FORMULATION AND EVALUATION OF COLOUR – CHANGE ANTIMICROBIAL PAD BY USING POVIDONE IODINE"

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ABSTRACT

Wound infection is one of the major challenges in wound management and may delay the normal healing process. Conventional wound dressings mainly act as physical barriers and do not provide visual indication regarding wound condition or antimicrobial activity. Therefore, the present study was focused on the preparation and evaluation of a colour-change antimicrobial wound care pad using simple pharmaceutical materials. The formulation was prepared using povidone iodine as an antimicrobial agent, soluble starch as a colour indicator, PVP as a polymer, and sterile cotton gauze as the dressing base. The wound care pad was prepared by dip-coating method followed by controlled drying. During formulation development, starch–iodine interaction produced visible blue colour indicating successful colour response within the dressing system. Different formulation trials were carried out to improve coating behaviour and flexibility of the prepared pad. The prepared dressing was evaluated for physical appearance, coating uniformity, flexibility, absorbency, and colour response. The study demonstrated that the prepared formulation possesses antimicrobial and visual indication properties. However, certain limitations such as non-uniform coating and reduced flexibility after drying were observed, indicating the need for further optimization. Overall, the present work successfully demonstrated the feasibility of developing a simple,

economical, and colour-change antimicrobial wound care pad using easily available materials and laboratory techniques.

KEYWORDS: Colour-Change Wound Dressing, Antimicrobial Wound Care Pad, Smart Wound Dressing, Povidone Iodine, Starch-Iodine Interaction, Wound Infection, Wound Healing.

1. INTRODUCTION

Wound infection is a common clinical Problem that can delay the healing process & may lead to serious complication. Conventional wound dressings mainly act as physical barriers & require frequent removal to assess the wound condition, which may disturb healing & increase the risk of secondary infection. To overcome these limitations, a colour change antimicrobial wound care pad is developed.[1]These pad not only provide antimicrobial protection but also gives a visual indication about the activity & effectiveness of the antimicrobial agent trough colour change, reducing the need for frequent dressing removal conventional wound dressings do not reveal information concerning infection or the state of healing; instead, they primarily shield the site from external contamination. Regularly taking off the dressing to examine the wound can lead to discomfort, tissue damage, and a higher chance of developing a secondary infection. An improved wound dressing system that can both give antibacterial activity and a visible indication of the state of the wound is therefore required. To get around these restrictions, a smart dressing solution called a colour-change antimicrobial wound care pad was created. Through the interaction between starch and iodine, it not only reduces microbial growth but also produces a visual colour indicator. This method could make it simpler to check the wound without having to take off the dressing frequently.[2]

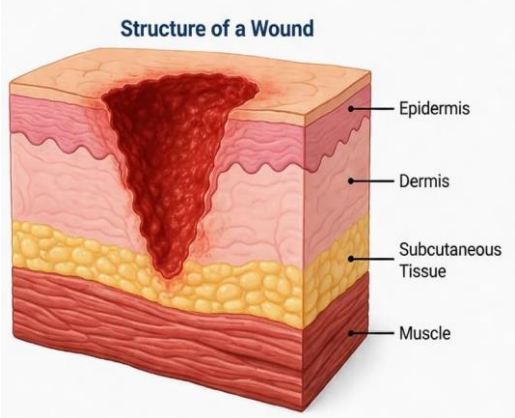

Fig. No. 1.1: Structure of Wound.

- **Wound Definition:** A disruption or break in the normal anatomical structure and function of the skin or underlying tissues is referred to as a wound. Burns, chemical exposure, infections, surgical operations, and physical injuries can all cause it. Damage to the skin's protective barrier against external hazardous chemicals might result in issues like infection and delayed recovery.[3]
- **Types of wound healing:** Wounds are broadly classified into two main categories:

a) Acute Injuries: Under normal circumstances, these wounds heal quickly.

Examples: Cuts, Abrasions, Wounds from surgery

Fig. No. 1. 2: Types of Wound Healing.

b) Persistent Injuries:

These wounds may last for weeks or months and require more time to heal.

Examples: Diabetes-related ulcers, Bed sores, also known as pressure sores, Venous ulcers, Chronic wounds need extra attention since they are more prone to infection.[4]

Wound Infection

When germs like bacteria, fungi or viruses get into the wound it can cause a wound infection.

Some common germs that cause infections are Escherichia coli and Staphylococcus aureus.

Causes of Wound:

i)My body gets more inflamed.

ii)I feel pain. See swelling.

iii)It takes longer for me to heal.

iv)Pus starts to form.

In bad cases the infection can spread to other parts of the body and cause big problems. So it is very important to prevent infection and keep it under control when taking care of wounds.

This is a part of wound management and infection control. The infection can. The wound management becomes more complicated.

Preventing infection and controlling it is essential, for wound management and infection.[5]

Antimicrobial Agents

Antimicrobial agents are chemicals that kill or stop bacteria from growing. They help prevent infections in wound care. Povidone iodine is an antibacterial agent. It is a mix of iodine and polyvinylpyrrolidone. This polymer slowly releases iodine. The released iodine then kills bacteria. Povidone iodine is often used in wound care because it is effective against types of bacteria -Penetrates microbial cells, Denatures proteins, Disrupts cell membranes, Leads to microbial death.

Povidone iodine works well against a wide range of microbes, such as viruses, bacteria, fungi, and protozoa.[6]

Types of wound dressing:

We use things called dressings on wounds to keep them safe and help them heal

There are a kind of wound dressings. Typical varieties of dressings consist of:

1. Traditional Dressings: Cotton gauze, Bandages, Simple pads

These provide basic protection but have limitations such as:The wound does not seem to be infected. This is disturbing the wound healing process of the wound healing process

2. Advanced Dressing

Hydrocolloid dressings, antimicrobial dressings [7]The pad is made with a gauze foundation that absorbs wound fluid and permits the medication to be released under controlled conditions.[7]

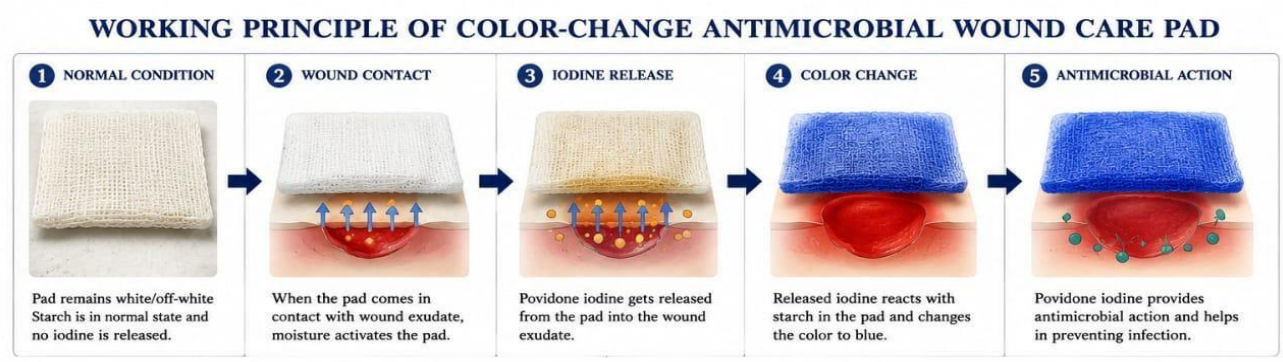

Fig. 1.3: Working Concept.

Significance of the Study

- The developed pad offers the following advantages:
- It helps to prevent infections.
- This method allows for visual checks, on the wounds condition.
- It also reduces how often you need to remove dressings.
- The formulation is simple. Won't break the bank.
- It works well in both lab settings and real-life situations.[8]

2. MATERIALS AND METHODS

2.1 Materials[9]

Table No. 5.1: List of Ingredient.

Sr. No	Ingredients	Category	Roll In Formulation
1.	Povidine Iodine	Antimicrobial Agent	Provide Broad Spectrum Antimicrobial Activity
2.	Soluble Starch	Indicator Material	Show Colour Change in presence of Iodine
3.	Polyvinylpyrrolidone (PVP)	Polymer	Forms Film And Improves Coating uniformity
4.	PEG – 400	Plasticizer	Improve Flexibility and prevents brittleness
5.	Distilled Water	Solvent	Used for preparation of Various Solution
6.	Sterile Cotton Gauze	Base Material	Acts as wound dressing support

Table No. 5.2 List of Apparatus / Equipment used[10]

Sr. No.	Apparatus / Instrument	Purpose
1.	Beaker	Preparation and mixing of solutions
2.	Measuring Cylinder	Measurement of Liquids
3.	Glass Rod	Stirring of Solution
4.	Weighing Balance	Accurate weighing of Chemicals
5.	Hot Plate	Heating of Starch Solution
6.	Dropper	Dropwise addition of Solutions
7.	Scissors	Cutting of gauze into required size
8.	Glass Tray / Petri Dish	Drying of coated gauze pads

2.2 Methods of Preparation:

Polymer solution was prepared by dissolving PVP in distilled water with continuous stirring.

Glycerine was added to improve flexibility of the formulation.

Starch solution was prepared by heating starch in distilled water to obtain smooth solution.

Povidone iodine solution was prepared separately in distilled water.

Starch solution was slowly added into polymer solution.

Povidone iodine solution was added dropwise with continuous stirring.

Sterile gauze pieces were cut into required size.

Gauze pieces were dipped into the prepared formulation for uniform coating.

Excess solution was drained and pads were dried under suitable conditions.[11]

Storage Conditions: Store in clean and dry container. Protect from heat and sunlight. Avoid moisture contamination Maintain sterile conditions during handling.[12]

3. RESULTS AND DISCUSSION

Sr. No	Evaluation Parameter	Observation
1.	Physical Appearance	Smooth And Uniform
2.	Colour Response	Blue colour observed
3.	Coating Uniformity	Uniform Coating on gauze
4.	Flexibility	Good After Optimized Coating
5.	Surface Texture	Smooth
6.	Absorbency	Good
7.	Drying Behavior	Stable After Proper drying
8.	Handling Property	Easy to Handle
9.	Gauze Integrity	Maintained
10.	Overall Formulation Status	Successfully Prepared wound care pad

The present study was successfully carried out for the preparation of colour-change antimicrobial wound care pad using povidone iodine, starch, PVP and sterile cotton gauze.

Starch solution prepared by heating showed smooth and uniform consistency. On addition of povidone iodine solution, immediate blue colour was observed indicating starch-iodine interaction. Excess povidone iodine caused dark brown colour and stiffness, while optimized amount gave uniform blue colour and better flexibility. Dip-coating method provided uniform coating on gauze surface. Proper drying resulted in stable, flexible and uniform wound care pad. The formulation showed good absorbency and maintained gauze integrity. The prepared pad combines antimicrobial property of povidone iodine with visual indication of starch. Before Addition of Povidone Iodine colour.

4.CONCLUSION

The present study was carried out for the preparation and evaluation of a color-change antimicrobial wound care pad using povidone iodine, starch, PVP, and sterile cotton gauze. The formulation was prepared successfully by dip-coating method using simple laboratory materials and techniques.

The study confirmed that starch and povidone iodine interaction produces visible color change, indicating the possibility of developing a smart wound dressing system with visual indication property. The prepared formulation also demonstrated the potential antimicrobial role of povidone iodine in wound care applications.

During practical trials, several formulation challenges such as uneven coating, excessive stiffness after drying, and non-uniform color distribution were observed. Excess addition of povidone iodine resulted in dark brown coloration, while controlled dropwise addition showed better blue color response. Proper drying conditions and controlled formulation quantity were found important for obtaining better dressing characteristics.

Although the final prepared gauze pad did not achieve completely ideal properties, the study successfully demonstrated the basic concept and feasibility of preparing a color-change antimicrobial wound care pad using simple pharmaceutical materials.

The work also provided practical understanding regarding formulation preparation, dip-coating technique, starch–iodine interaction, drying behavior, and evaluation of wound dressing systems.

Overall, the study concludes that color-change antimicrobial wound care pads can be developed using simple and economical methods, but further optimization is required to improve coating uniformity, flexibility, stability, and overall dressing performance.

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