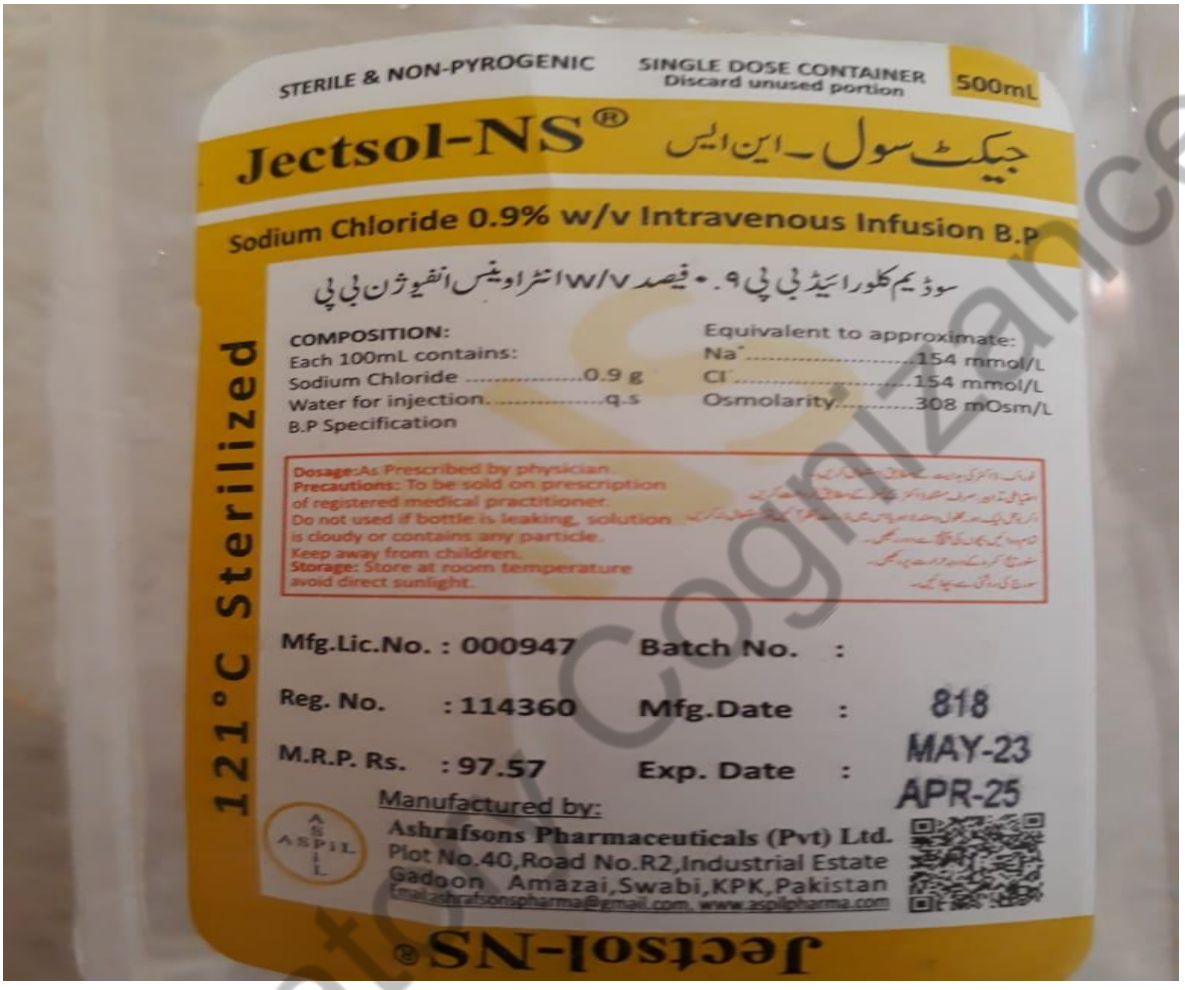
**Q: How would you prepare a saline solution in a laboratory, ensuring its concentration or strength, if you were provided with sterile saline water purchased from the market, with the composition section indicating that each 100 mL contains 0.9 grams of NaCl?**




For preparing **500 mL of a 0.9% (w/v) saline solution** in a professional laboratory setting, you will follow a precise procedure to ensure accuracy & consistency. Here's a detailed Instructions:

**Concentrations of the Saline Solution**

- **Percentage (w/v)**: 0.9%
- **Molarity (M)**: 0.154 M
- **Normality (N)**: 0.154 N

**Materials Needed:**

- Sodium chloride (NaCl)
- Distilled water
- Analytical balance
- Volumetric flask (500 mL)
- Beaker (500 mL)
- Stirring rod or magnetic stirrer
- Personal protective equipment (gloves, lab coat, safety glasses)

**Procedure:**

**Calculate the Amount of NaCl Needed**:

- Since 0.9% (w/v) means 0.9 grams of NaCl per 100 milliliters of solution, for 500 mL:

$$\text{Amount of NaCl} = 0.9\text{g}/100\text{ mL} \times 5\text{mL} = 4.5\text{g}$$

- **Weigh the NaCl**:
  - Use an analytical balance to accurately weigh 4.5 grams of NaCl. Ensure the balance is properly calibrated for precision.
- **Dissolve the NaCl**:
  - Pour about 400 mL of distilled water into a clean beaker. Using less than the final volume allows space for thorough mixing.
  - Add the weighed 4.5 grams of NaCl to the distilled water in the beaker.
  - Stir the solution with a glass stirring rod or use a magnetic stirrer until the NaCl is completely dissolved.
- **Transfer to Volumetric Flask**:
  - After the NaCl is fully dissolved, carefully transfer the solution to a 500 mL volumetric flask.
  - Rinse the beaker with a small amount of distilled water and add the rinsing to the volumetric flask to ensure all NaCl is transferred.
- **Adjust the Final Volume**:
  - Add distilled water to the volumetric flask until the bottom of the meniscus is at the 500 mL calibration mark. Ensure that you are viewing the meniscus at eye level to avoid parallax error.

- **Mix the Solution**:
    - Cap the volumetric flask and invert it several times to ensure the solution is homogeneous.

**Safety and Handling:**

- Wear appropriate personal protective equipment (PPE) such as gloves, a lab coat, and safety glasses when handling chemicals.
- Ensure all glassware and equipment are clean and free from contaminants.
- If you spill any chemicals, clean up immediately following your lab's safety protocols.

**Verification:**

- Optionally, verify the concentration of your saline solution by measuring its conductivity or density and comparing it with standard values for 0.9% saline.

By following these steps, you will prepare a 500 mL 0.9% (w/v) saline solution accurately and professionally. Adjust the amounts if a different volume or concentration is required.

**<u>To calculate the molarity & normality of the 0.9% (w/v) saline solution, follow these steps:</u>**

**Molarity (M):** Molarity is defined as the number of moles of solute (NaCl) per liter of solution.

- **Determine the amount of NaCl in grams**:
    - For a 0.9% (w/v) saline solution, we have 0.9 grams of NaCl per 100 milliliters of solution.
    - For 500 milliliters of solution, we have:

$$\textit{Amount of NaCl} = 0.9\ \text{g}/100\ \text{mL} \times 500\ \text{mL}/100 = 4.5\ \text{g}$$

**Calculate the number of moles of NaCl**:

- The molecular weight of NaCl is approximately 58.44 g/mol.
- Number of moles of NaCl:

$$\text{Moles of NaCl} = 58.44\ \text{g/mol}4.5\ \text{g} \approx 0.077\ \text{mol}$$

- **Calculate the molarity**:
    - Molarity (M) is moles of solute per liter of solution.
    - Since we have 500 milliliters (0.5 liters) of solution:

$$\textit{Molarity} = 0.077\ \text{mol}/0.5\ \text{L} = 0.154\ \text{M}$$

**Normality (N):**

Normality is defined as the number of equivalents of solute per liter of solution. For NaCl, which dissociates into $Na^+$ and $Cl^-$, the equivalent weight is the same as the molar mass because each mole of NaCl provides one equivalent of $Na^+$ and one equivalent of $Cl^-$.

- **Determine the equivalents of NaCl**:
  - For NaCl, 1 mole provides 1 equivalent.
  - Therefore, the number of equivalents is the same as the number of moles.

**Equivalents of NaCl=0.077 equivalents**

- **Calculate the normality**:
  - Normality (N) is equivalents of solute per liter of solution.
  - For 500 milliliters (0.5 liters) of solution:

$$Normality = 0.077 \text{ equivalents} / 0.5 \text{ L} = 0.154 \text{ N}$$

Therefore, both the molarity & normality of the 0.9% (w/v) saline solution are 0.154 M and 0.154 N, respectively.



## Autoclaving the Saline Solution

- **Sterilization Requirement**: If the saline solution is going to be used in any procedure where sterility is crucial, such as in cell culture, microbiological assays, or medical applications, you should autoclave the solution. Autoclaving will ensure that the solution is free from any microbial contaminants.

**Procedure for Autoclaving:**

1. **Prepare the Solution**: Make sure the saline solution is prepared in a suitable autoclave-safe container, such as a glass bottle with a loose cap or an autoclave bag. Do not fill the container completely; leave some space to allow for expansion during autoclaving.
2. **Autoclave Settings**: Typically, you would autoclave at 121°C (250°F) for 15-20 minutes at 15 psi. Verify the specific settings recommended for your autoclave.
3. **Cooling**: Allow the autoclaved solution to cool to room temperature before use. Ensure the cap is tightened after autoclaving to maintain sterility.

**Not Autoclaving the Saline Solution**

- **Non-Sterile Applications**: If the saline solution is being used for applications where sterility is not critical, such as washing glassware, making buffers for non-sterile chemical reactions, or general lab cleanup, autoclaving is not necessary.

**Additional Considerations:**

- **Chemical Stability**: Ensure that the chemical components of the solution (in this case, NaCl and water) are stable under autoclaving conditions. NaCl & water are stable and will not decompose or react under typical autoclave conditions.
- **Labelling**: Clearly label the solution with the date, concentration, and any special instructions, such as "sterile" if it has been autoclaved.

**Final Recommendation**

For applications requiring sterility, autoclave the saline solution. For non-sterile uses, autoclaving is unnecessary. Always consider the specific needs of your experiments and follow lab protocols accordingly.



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