



SOP: IRS Block Preparation

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Timeline

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1	30/10/2020	Angus Spiers	I2I
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Version Control¹

Version	Date	Updated by	Description of update(s)
2	June-July 2022	Alex Wright, Katherine Gleave	Related documents, purpose, materials & equipment, data collection sheet information, health and safety, glossary of terms and references added.

¹ Historical versions of SOPs can be found on the I2I website (<https://innovationtoimpact.org/>)

Related documents

- I2I Best Practice SOP Library, 30 October 2020 (<https://innovationtoimpact.org/>)
 - SOP Cone bioassay of IRS Treated Blocks (I2I-SOP-010)
 - Spraying Insecticides with the Potter Tower (I2I-SOP-012)

1. Purpose

This SOP outlines the procedures to be followed to produce cement and mud blocks. These blocks are later used to test the efficacy of different products and new formulations for Indoor Residual Spraying (IRS) applications in the laboratory.

2. Background

The World Health Organisation (WHO) cone is 12 cm in diameter, the minimum size required for a substrate sample to be tested. Blocks of cement or mud, 1-1.2 cm thick, are prepared in Petri dishes and dried at $27\text{ °C} \pm 2\text{ °C}$ and $80\% \pm 10\%$ Relative Humidity (RH). These and the substrates not requiring pre-preparation, such as wood or thatch, are sprayed with insecticide to make a homogeneous residual deposit of the desired concentration of active ingredient per unit area. Spraying is done using a Potter Spray Tower®, which is internationally recognized as the most precise method of chemical spraying in the laboratory. All substrate samples are stored unsealed under controlled temperature conditions ($30\text{ °C} \pm 2\text{ °C}$), humidity (80%), air circulation and ambient light cycles until ready for testing. A minimum of seven replicate blocks per dosage are prepared, at least three for bioassay and four for initial chemical analysis, selected at random.

The plywood, mud, cement and sand used in the preparation of blocks should be obtained from the same source for every study to minimize variation in the physical and chemical properties of these substrates between studies.

3. Materials and equipment

3.1. Block preparation.

- Lab coat, gloves, goggles, dust mask
- Substrate being used (mud, sand, concrete/cement, wood)
- Label
- Marker pen
- Petri dish (for mud and concrete)
- A4 paper
- Sieve
- Weigh scale
- Graduated cylinder
- Plastic bowl
- Spoon

3.2. pH testing

- Scalpel
- Sandpaper (for wood substrate)
- Calibrated pH meter
- Litmus paper (if no pH meter)

4. Procedure

4.1. Block preparation

Blocks should be prepared and dried at $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $80 \pm 10\%$ RH. Blocks should then be stored unsealed after spraying at $30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 80% RH, with ambient light cycles and air circulation until testing.

4.1.1. Plywood.

- 4.1.1.1. Cut the plywood into 10cm diameter circles. Plywood can be cut into a square for ease, but a circle must be drawn around the sprayed area to ensure the cone is placed in the correct place.

4.1.1.2. Place a label on the bottom of the plywood and insert details on the initials of the person preparing the block and the date of preparation.

4.1.2. Mud.

4.1.2.1. Use a lab coat, dust mask and safety goggles when making up mud blocks.

4.1.2.2. Follow local recipe for the mixing of mud, sand (if appropriate), cement (if appropriate) and water (should match recipe for making houses).

4.1.2.3. Label the bottom of the petri dish with a labeling stating the initials of the person preparing the block and the date of preparation.

4.1.2.4. Cut a 10cm diameter piece of A4 paper to line the petri dish. This facilitates the removal of the block from the petri dish when it is needed for an assay.

4.1.2.5. Sieve the sand and soil separately to remove stones, gravel, and lumps.

4.1.2.6. Weigh the sand [if appropriate] and mud and measure out the water using a glass measuring cylinder.

4.1.2.7. If the study protocol or Study Director dictates stabilization of mud blocks with cement, this can also be added to the mixture.

4.1.2.8. Add all raw materials together in a plastic bowl. Stir the mixture with a spoon labeled "mud" for three-five minutes until it has an even appearance. Use the back of the spoon to smooth the surface of the block in small circular motions until it is as smooth as possible.

4.1.2.9. Prepare enough of the mux mixture to make all the mud blocks required for the study.

4.1.2.10. Fill the petri dish to the surface with the mud and level the surface with the back of the "mud" spoon.

4.1.2.11. Put blocks in a block storage room under the correct drying conditions $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$, $80\% \pm 10\%$ RH for minimum of one week.

4.1.3. Concrete

- 4.1.3.1. Use a dust mask, safety goggles, lab coat and gloves when making up concrete blocks.
- 4.1.3.2. The recipe for the mixing of cement, sand and water should be inserted here. The recipe should reflect local practices for the use of cement in houses]
- 4.1.3.3. Prepare enough cement mixture to prepare all of the blocks required for the study.
- 4.1.3.4. Cut a 10cm diameter piece of plain A4 paper to line the petri dish. This facilitates the removal of the block from the petri dish when needed for an assay.
- 4.1.3.5. Sieve the sand and cement separately to remove dirt and lumps
- 4.1.3.6. Weigh the sand and cement and measure out the water (using a glass measuring cylinder) to the required amounts.
- 4.1.3.7. Add the cement to the sand in one plastic bowl. Stir the mixture with a spoon labeled "concrete", then add the water and continue to stir for three-five minutes until it has an even appearance.
- 4.1.3.8. Fill the petri dish to the surface with the concrete and level the surface.
- 4.1.3.9. Put blocks in a block storage room under the correct drying conditions $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$, $80\% \pm 10\%$ RH for minimum of four-five days.
- 4.1.3.10. Once set, immerse the concrete blocks (still in petri dishes) in tap water for three days.
- 4.1.3.11. Put the blocks back in the block storage room for 24 hours or until dry.
- 4.1.3.12. A label should be placed on the bottom of the concrete blocks with the initials of the person who prepared the blocks, and the preparation date.
- 4.1.3.13. Concrete blocks should be left in the block storage room for a minimum of one month to cure at $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $80\% \pm 10\%$ RH before used in assays

4.2. pH testing.

4.2.1. The pH should be between six and eight for blocks to be used for testing. pH testing should be conducted on the day they are to be sprayed with insecticide.

4.2.2. Using pH meter

- 4.2.2.1. Use a scalpel blade to scrape 5g of mud or concrete evenly from the surface of the block. For plywood, use sandpaper to remove 1g of plywood from the surface. Add 15mL tap water and mix thoroughly.
 - 4.2.2.2. Swirl pH meter in tap water before use to remove any particles from the bulb. Ensure meter is calibrated.
 - 4.2.2.3. Put pH meter in the solution so the bulb is fully submerged. Wait until reading stabilizes.
 - 4.2.2.4. Record the reading on a label on the underside of all blocks made that day
- 4.2.3. Using litmus paper
- 4.2.3.1. Use a scalpel blade to scrape 5g of mud or concrete from the block. For plywood, use sandpaper to remove 1g of plywood from the surface. Add 15mL tap water and mix thoroughly.
 - 4.2.3.2. Wearing gloves, take a clean strip of litmus paper, holding it by one end, and dip into the solution for five seconds.
 - 4.2.3.3. Use the colored chart on the litmus paper packaging to estimate the pH to the nearest whole number.
 - 4.2.3.4. Record the reading on a label on the underside of all blocks made that day.

4.3. Spraying blocks

- 4.3.1. Follow SOP for block spraying using Potter Tower.
- 4.3.2. On day of spraying, the chemical code of the insecticide sprayed, test item code, and protocol number should be written on a label on the bottom of the block.

4.4. Discarding blocks

- 4.4.1. Unsprayed. The expiry for untreated mud blocks is two months after blocks are made, six months for concrete and plywood. Untreated blocks can be disposed in normal waste bins.
- 4.4.2. Sprayed. Sprayed blocks should be disposed following national insecticidal waste guidelines for each country.

4.5. Collection and reporting of data

4.5.1. Block preparation and storage record sheet

- Date blocks made
- Initials of staff members making blocks
- Block type
- Quantity made
- Quantity of raw materials (sand, cement, soil, water)
- Shelf ID number
- Removal information
- Disposal date

5. Health and Safety

For GLP-compliant laboratories, the following should be installed in the laboratory prior to testing:

5.1. Physical structure health and safety

- Fume hood/plastic enclosure for the Potter Tower
- Negative air pressure in insecticide storage room and spray room
- Including ventilation fans in insecticide storage room and in spray room
- Spill kit
- Emergency shower
- Emergency eye wash

5.2. Personal protective equipment (PPE)

Recommended for handling insecticide in laboratory spray room and for spraying

- Spray suit coveralls

- Respirator mask (fit-tested for the specific individual spraying)- check AI Material Safety Data Sheet for filter requirements
- Gloves
- Goggles and/or Visor
- Over boots

6. Glossary of terms

AI	Active Ingredient
CREC	Centre de Recherches Entomologiques de Conotou
GLP	Good Laboratory Practice
I2I	Innovation to Impact
IRS	Indoor Residual Spray
KCMUCo	Kilimanjaro Christian Medical University College
PPE	Personal Protective Equipment
RH	Relative humidity
SOP	Standard Operating Procedure
WHO	World Health Organisation
WHOPES	World Health Organization Pesticide Evaluation Scheme

7. References

WHOPES guidelines- Testing mosquito adulticides for indoor residual spray and treatment of mosquito nets



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