

PROTOCOL FOR BONDING FLAT OYSTERS TO SUBSTRATES

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Adherence Protocol used for the outplacement of flat oysters in the North Sea by van Oord, October 2020

Short note and overview

This protocol is developed to facilitate the speedy and successful bonding of flat oysters to substrate. The choices and steps are based on a sequence of field and laboratory experiments to find the best combination of glue and substrate and fine-tune the application procedure.

The bonding protocol consists of three steps:

1. Drying oysters before gluing
2. Gluing of oysters on substrate
 - a. Preparing the glue
 - b. Applying the glue
3. Drying of the glue before deployment

Note! Especially step 1 is critical to make sure the bonding of the glue is optimal. Therefore, it is important to take extra care to work in a dry environment and keep the shells as dry as possible before applying the glue. Optionally, to speed up the drying blow-drying the shells using compressed air or a hairdryer can be good solution.

Materials & tools

Materials

- | | | |
|-----------------------------|------------|------------------------|
| ○ Bison Kit 2K Polyurethane | (NIOZ) | 12 pots (750 + 150 gr) |
| ○ Flat oysters | (van Oord) | 1000 |
| ○ Substrates | (van Oord) | Device |

Tools

- | | | |
|--|-------------------|--|
| ○ Measuring cups | (NIOZ) | |
| ○ Paste + hardener | | 45 (pre-measured) for paste (+ hardener) |
| ○ Hardener | | 3 (pre-measured) for 40 gr hardener |
| ○ Laboratory gloves | (NIOZ / van Oord) | 2 boxes |
| ○ Drying / wiping paper | (NIOZ / van Oord) | 1 role |
| ○ Small yellow spatulas | (NIOZ) | 17 |
| ○ Tablespoons | (van Oord) | 1-5 |
| ○ Compressed air or hairdryer (Optional) | | |

Preparation and application

Drying of the oysters before gluing

Aim: The shell of the oysters should be clean and as dry as possible before it is glued to the substrate. To achieve this and improve the bonding the following, therefore the following actions are recommended:

- Brush or wash down dirt from oysters with seawater at sea temperature
- Dab and wipe off excessive water (moist) with wiping paper as much as possible
- Lay down wiping paper in crates and place oysters on paper, next to each other with some space between them.
- The shells dry best with the flat side up and the convex side down on paper (see picture)
- Preferably dry at room temperature (20°C) for a minimum of 2-3 hours (but preferably up to 24 hours) in a well ventilated room.
- If possible, blow the oysters dry with compressed air or hairdryer.



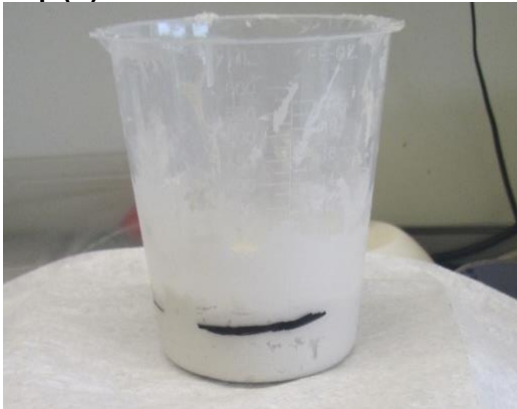
Preparation of the adhesive (Polyurethane mix)

The most accurate approach and preferable method to mix the two component of the polyurethane glue is to weight the two components 5:1 on a balance (200 g paste : 40 g hardener for bonding 40-45 oysters to substrate). However, this is impractical for on-board practice without laboratory facilities. Therefore, the method described here makes use of pre-marked cups.

NOTE: Use gloves to avoid contact with skin. Change gloves regularly to diminish contamination with the surroundings.

- Use the cups with predetermined volumes (see photos):
 - One (A) for administering 5 units of paste (200 grams) + mixing.
 - One (B) for measuring 1 unit of hardener (40 grams).
- Use tablespoon to place paste in cup (A), up to the marked level (equals 175 ml)
- Smear and press down the paste to make sure it is flat and equally distributed in the cup. Make sure holes and bubbles are removed to acquire right weight (200 g) volume based.
- Use cup (B) for administering 1 unit (40 g) of hardener (equals 38-40 ml).
- Pour out cup (B) into cup (A) directly onto the paste. Avoid spilling hardener onto sides of cup to make sure the proportions are close to the 5:1.
- Mix paste and hardener with yellow spoon in cup (A) into homogenous sticky mass (see photo).

Cup (A)



Cup (B)



Paste after mixing:



Bonding the oysters to substrate

- **Important!** Before applying the glue make sure the shell surface and substrate are dry. Remove any moisture by blotting dry with a paper towel and -if available- dry-blowing with air.
- Use the yellow spoon used for the mixing to apply 4-5 grams of mixed paste onto oyster. Apply the glue homogeneously in the centre of the shell, but do not allow the glue to get to the edges so that the shell remains closed (see photo).
 - One prepared cup should provide sufficient glue for 40-45 oysters
 - **Note:** applying the glue should be easy (sticky), if repelled (e.g. rolling) oyster is too wet. Take additional action to dry the surfaces e.g. by drying longer, blotting, or blow-drying.
- Press oyster onto substrate and press down for 5-10 seconds (see photo)
 - If dryness of oyster and mix are correct, slight suction should be felt
- Space oysters well. Ideally oysters have space to grow up to e.g. 15 ~ 20 cm in diameter.
- **Important!** Let the glue dry combination for 3-4 hours before outplacing.

