



## Information on factory pre-treated nets and conventional treatment of coloured mosquito nets WHO, Geneva, 20/09/2003



### 1. Quality control of factory pre-treated nets

(other than long-lasting insecticidal nets)

WHO and UNICEF have recently carried out quality control on factory pre-treated nets purchased for national malaria control programmes. Chemical analysis have been made by a WHO Collaborating Centre with 3 batches of polyester nets (not long lasting) purchased from 2 major net manufacturers. Following results have been obtained:

- Permethrin EC, white nets, target concentration 250-500 mg/m<sup>2</sup>, 20 samples collected, average concentration found: **78.8 mg/m<sup>2</sup>** (min: 34.4, max 148.6, std. deviation: 36.8).
- Deltamethrin SC, light green nets, target concentration 21-25 mg/m<sup>2</sup>, 10 samples collected, average concentration: **10.9 mg/m<sup>2</sup>**.
- Deltamethrin SC, target concentration: 25 mg/m<sup>2</sup>:
  - White (40 composite samples from 120 nets): average concentration **16.7 mg/m<sup>2</sup>** (0.4-58.8, s.d.: 16.6).
  - Green (40 composite samples): average concentration **20.7 mg/m<sup>2</sup>** (1.6-84.2, s.d.: 16.4).
  - Blue (40 composite samples): average concentration **11.2 mg/m<sup>2</sup>** (1.6-33.7, s.d.: 7.4).

**Conclusion:** There is evidence of a high variability of insecticide concentration in factory pre-treated nets. Observed concentrations have been lower or much lower than expected.

**Recommendation:** Control programmes and institutional buyers are advised, whenever possible, to avoid the purchase of factory pre-treated nets unless they are of the long-lasting insecticidal type (LLIN) recommended by WHO.

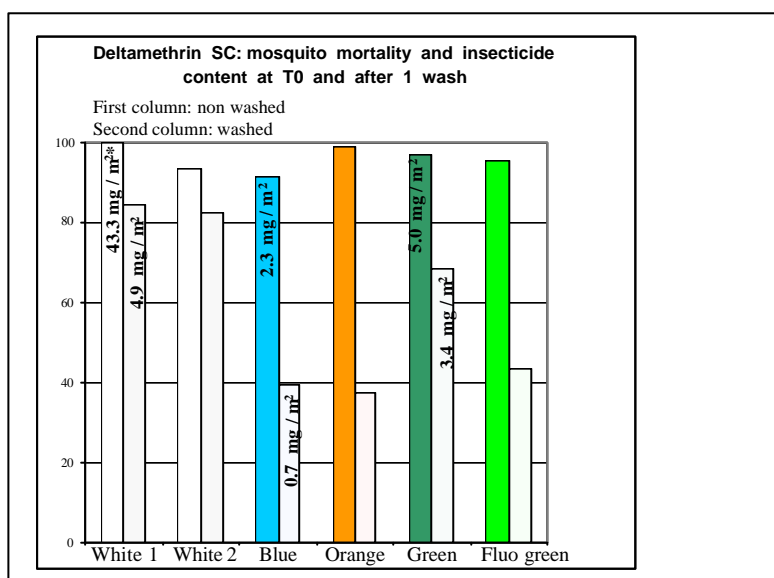
### 2. Treatment of coloured nets

**Background:** Nowadays, more coloured nets are purchased by institutional buyers than white nets (63.7 % coloured versus 36.3 % white for UNICEF in 2002). WHO's attention has been drawn to the difficulty encountered by one manufacturer in the production of coloured LLINs (low uptake on insecticide). Since the same problem may also occur during conventional dipping of coloured nets, WHO has commissioned a Collaborating Centre to carry out preliminary investigations on this topic.

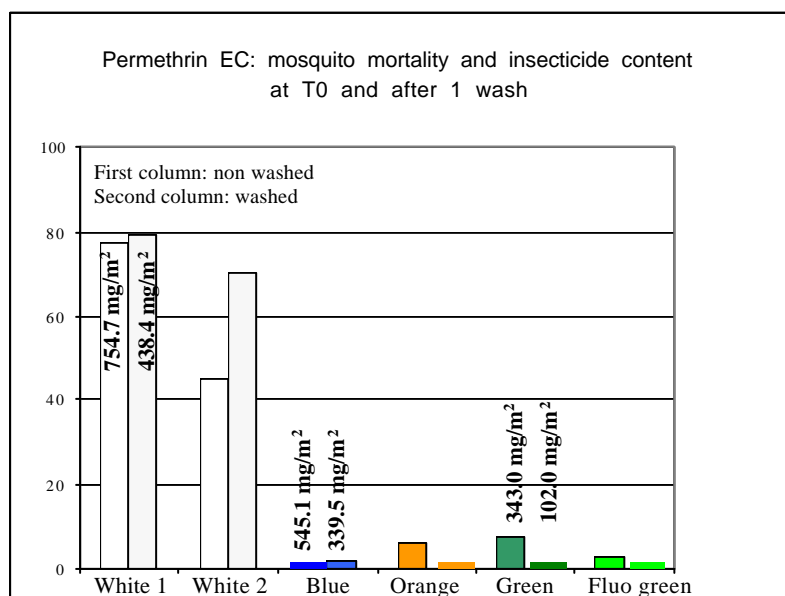
**Test procedure:** Four (4) coloured and 2 white netting samples were collected from two major manufacturers. Net samples have been individually treated in the laboratory by standard dipping with deltamethrin SC and permethrin EC at a target concentration of 25 and 500 mg/m<sup>2</sup> respectively. Efficacy has been measured exposing *Anopheles gambiae* females for 3 minutes under WHO cones (3 replicates, 150 females replicate). White and coloured nets have been tested respectively 1 week after treatment and just after a standard wash, following the procedure currently recommended by WHO for measuring wash resistance of long lasting nets. Samples have been sent for chemical analysis to another WHO Collaborating Centre.

**Results:** from graphs 1 (deltamethrin SC) and graph 2 (permethrin EC), there is evidence of a potential problem in conventional treatment (dipping) of coloured mosquito nets. In the case of deltamethrin, the uptake of insecticide by blue and dark green nets has been reduced by 94.6 % and 88.6 % respectively when compared with white net. Immediate efficacy of coloured nets was good for the four colours tested. This was not surprising knowing that the minimum active concentration of deltamethrin on netting material is around 3 to 5 mg/m<sup>2</sup>. In this case, bio-availability of the insecticide has been good. However, contrary to white nets, efficacy of coloured nets dramatically dropped after the first wash because of the low initial uptake.

In the case of permethrin EC, a quite different result has been obtained: initial uptake by blue and green nets has been reduced by no more than 28 and 55 % respectively but efficacy has been very low with all coloured nets, even not washed. This surprising result can be potentially explained by a problem in bio-availability of the insecticide. Uptake of insecticide solution measured by weight has been -30%, -10%, -7% -16% and +3% respectively with white, blue, orange, green and fluorescent green as compared to the white reference netting (white 1).



**Graph 1:** bioassay (% mortality) and chemical analysis (mg/m<sup>2</sup>) results of white and coloured nets, non washed and washed. Treatment by dipping in deltamethrin SC solution, target concentration 25 mg/m<sup>2</sup>.



**Graph 2:** bioassay (% mortality) and chemical analysis results (mg/m<sup>2</sup>) of white and coloured nets, non washed and washed. Treatment by dipping in permethrin EC solution, target concentration 500 mg/m<sup>2</sup>.

**Conclusion:** At this stage, it would be premature to draw any firm conclusion on the efficacy of coloured nets treated by conventional dipping. However, these preliminary results are clearly pointing out a potential problem. More investigations are needed to better understand the extent of this problem and whether it is related to the dyeing itself (nature of the dye, colour, intensity..), the insecticide (active ingredient, formulation) and to which extent the problem persists once the first few washes have removed the excess dye from the netting material. WHO is commissioning additional investigations on this question.

**Recommendation:** For the time being and waiting for more precise information on the conventional dipping of coloured nets, control programmes and institutional buyers ordering non treated nets may consider, whenever possible, to give preference to white nets.

**NB:** This document is targeting institutional buyers and procurement and quality control agencies, NGOs, industry involved in ITN programmes. A shorter version is to be released for Malaria Control Programme Managers and field personnel.

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