

The use of waste polystyrene as feed for mealworms (*Tenebrio molitor*)

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This study aimed to determine what percentage of the feed provided to the mealworm larvae of *Tenebrio molitor* (MWL) could be substituted by polystyrene (PS) whilst retaining mealworm viability. The survival and growth rates, as well as the general performance of the larvae, were followed for a 6-week duration.

Four test groups in three independent replicates of MWL, each with 300 larvae at the 8th instar, were fed on varying PS-bran percentages for six weeks under standard growth environment conditions. The four feeding regimes were 0, 50, 75 and 100% PS. The remainder of the feed for the 0, 50 and 75% groups was wheat bran. A 5g carrot supplement was provided for all groups weekly. The mealworms were monitored for mortality, percentage weight gain (%WG) and percentage length gain (%LG), and changes in their lipid and protein content at the end of the 6-week trial.

Feeding solely PS did not provide the best degradation of PS, with only 27.39% degradation in six weeks. The 75% PS treatment had the lowest %PS consumption at 21.74%. The best alternative was to provide a feed consisting of 50-50 PS-wheat bran supplemented with carrots giving the highest %PS consumption at 31.06%. Furthermore, over six weeks, the 50% PS treatment larvae had the best %LG and %WG at 47.1% and 278.6%, respectively. By comparison, the 100% PS treatment achieved a %LG and %WG of 36.6% and 205.4 respectively. Mortalities of the 50% PS treatment were of 54.7%, similar to the 75% PS group, whilst, for the 100% PS, mortalities were 73.89%. The control group achieved the lowest mortalities at 22.78%.

An additional test was conducted to investigate if a diet consisting of 50% PS significantly affected the protein and lipid content of the MWL compared to the control group. Analysis showed a statistically significant difference in protein content, with the 50% PS diet resulting in a higher protein content of 56.49% and 25.51 % lipid content, on a dry matter basis, when compared to the control group.

In conclusion, the 50% PS treatment larvae gave the best larval growth and survival rates out of the three treatments with PS provided in their diet, whilst the 100% PS gave poor results as PS degradation was not as efficient in this test group. A better approach to making use of waste PS is actually to provide the PS as part of a diet supplemented with natural feeds, such as wheat bran and carrots. For the commercialising of this concept, further studies need to be conducted.