# Laboratory Evaluation and Bioavailability of Soil Termiticides Against Subterranean Termites in Tropical Soil at Various Temperatures

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- To determine the half-life of pesticide used in soil with different condition. (concentration, temperature and soil type)

# Introduction

- About 6 million chemical compounds produce, about 1000 new product synthesis annually and between 60000 to 95000 chemicals are commercially used (Ortiz et al., 2013)
- Termiticide used for soil treatment will create a barrier surrounding the structure to avoid termite infestation.
- Soil termiticide treatment effectiveness may vary according to location (Ramakrishnan et al., 2000)

# Materials & Methods: Termiticide Degradation

Soil sample collection

Termiticide set in three concentration (Saran & Kamble, 2008)

with different temperature (30 & 40°C)

Ultra performance Liquid Chromatography (UPLC analysis)

Confirm by Bioassay

# Result: Degradation & Half Life

| Source | df | Mean Square | F | Sig. |
|---|---|---|---|---|
| Soil | 1 | 30.08 | 0.95 | 0.33 |
| Month | 3 | 2455.8 | 77.38 | **0** |
| Termiticide | 2 | 5606.75 | 176.66 | **0** |
| Concentration | 2 | 604.95 | 19.06 | **0** |
| Temperature | 1 | 102.73 | 3.24 | 0.07 |
| Soil * Month | 3 | 86.22 | 2.72 | 0.05 |
| Soil * Termiticide | 2 | 40.06 | 1.26 | 0.29 |
| Soil * Concentration | 2 | 0.88 | 0.03 | 0.97 |
| Soil * Temperature | 1 | 129.13 | 4.07 | 0.05 |
| Month * Termiticide | 6 | 414.34 | 13.06 | **0** |
| Month * Concentration | 6 | 32.36 | 1.02 | 0.41 |
| Month * Temperature | 3 | 744.9 | 23.47 | **0** |
| Termiticide * Concentration | 4 | 32.89 | 1.04 | 0.39 |
| Termiticide * Temperature | 2 | 78.86 | 2.49 | 0.09 |
| Concentration * Temperature | 2 | 4.09 | 0.13 | 0.88 |
| Soil * Month * Termiticide | 6 | 8.48 | 0.27 | 0.95 |
| Soil * Month * Concentration | 6 | 3.99 | 0.13 | 0.99 |
| Soil * Month * Temperature | 3 | 53.42 | 1.68 | 0.17 |
| Soil * Termiticide * Concentration | 4 | 4.22 | 0.13 | 0.97 |
| Soil * Termiticide * Temperature | 2 | 8.46 | 0.27 | 0.77 |
| Soil * Concentration * Temperature | 2 | 5.87 | 0.19 | 0.83 |
| Month * Termiticide * Concentration | 12 | 44.2 | 1.39 | 0.17 |
| Month * Termiticide * Temperature | 6 | 180.72 | 5.69 | **0** |
| Month * Concentration * Temperature | 6 | 44.62 | 1.41 | 0.21 |
| Termiticide * Concentration * Temperature | 4 | 5.59 | 0.18 | 0.95 |

# Materials & Methods: Bioassay (Bioavailability)

Healthy termites were selected

Soil samples/ termites bait will be weighed 18 g each and placed in petri dish

Termites placed in a petri dish

Observation

Examine using Probit analysis and Tukey honestly significant difference (HSD)

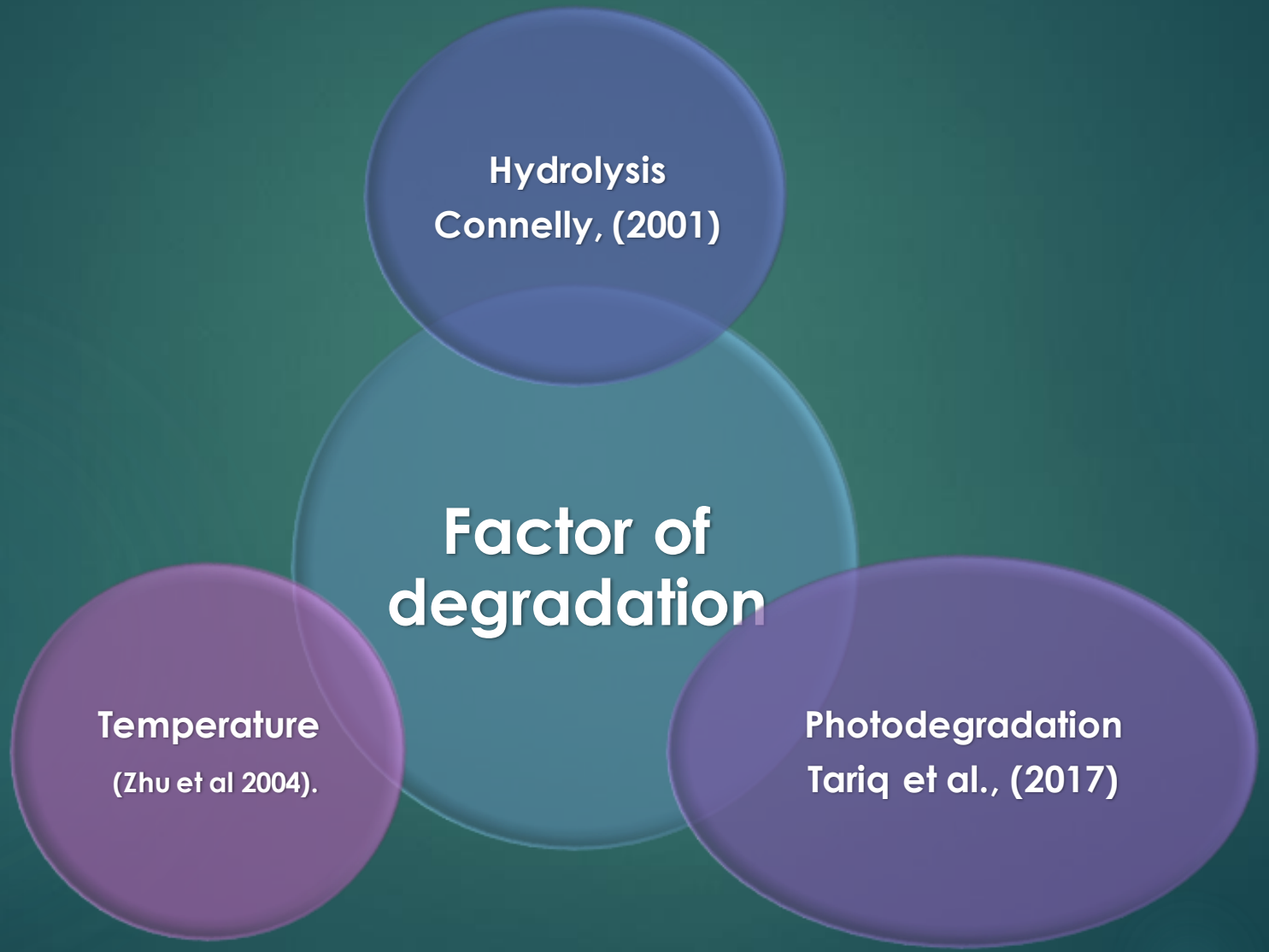
# Result: Bioassay (bioavailability)

| Month | Soil | Termiticide | Concentration | Temperature (°C) | Slope±SE | LT50 | LT95 |
|---|---|---|---|---|---|---|---|
| 1 month | Sandy loam | Bifenthrin | High | 30 | 3.019±0.336 | 8.952(6.545-11.221) | 31.387(22.316-62.7) |
| | | | Medium | 30 | 3.283±0.383 | 11.524(8.672-14.424) | 36.53(25.417-84.623) |
| | | | Low | 30 | 5.565±0.776 | 17.912(15.215-20.267) | 35.375(28.874-55.755) |
| | Loamy sand | Bifenthrin | High | 30 | 1.701±0.095 | 10.216(7.11-13.683) | 94.714(73.034-128.711) |
| | | | Medium | 30 | 2.047±0.099 | 15.955(12.41-19.719) | 101.464(77.706-143.932) |
| | | | Low | 30 | 2.065±0.121 | 17.625(13.24-22.141) | 110.358(89.957-141.133) |
| | Sandy loam | Fipronil | High | 30 | 2.241±0.118 | 22.72(16.867-28.711) | 123.11(95.047-174.001) |
| | | | Medium | 30 | 2.595±0.133 | 27.523(22.106-32.963) | 118.485(94.457-160.973) |
| | | | Low | 30 | 2.558±0.135 | 28.175(23.035-33.315) | 123.812(100.28-163.54) |
| | Loamy sand | Fipronil | High | 30 | 5.551±0.737 | 16.98(15.465-18.361) | 33.595(29.256-41.954) |
| | | | Medium | 30 | 4.181±0.705 | 22.615(19.313-28.862) | 55.947(38.518-176.767) |
| | | | Low | 30 | 7.795±1.055 | 26.413(21.535-32.143) | 42.936(34.255-114.334) |
| | Sandy loam | Imidacloprid | High | 30 | 3.168±0.195 | 46.346(42.249-50.294) | 153.215(136.729-175.949) |
| | | | Medium | 30 | 4.025±0.305 | 62.506(57.463-67.105) | 160.155(144.49-182.813) |
| | | | Low | 30 | 5.814±0.413 | 79.836(75.693-83.729) | 153.152(141.995-168.54) |
| | Loamy sand | Imidacloprid | High | 30 | 2.957±0.182 | 34.741(29.393-39.81) | 125.051(106.423-154.191) |
| | | | Medium | 30 | 3.72±0.267 | 51.191(46.614-55.392) | 141.706(127.911-161.149) |
| | | | Low | 30 | 5.526±0.432 | 71.986(63.872-78.748) | 142.865(126.678-171.536) |

# Result: Bioassay (bioavailability)

| Source | df | Mean Square | F | Sig. |
|---|---|---|---|---|
| Soil | 1 | 188.5 | 0.399 | 0.528 |
| Month | 3 | 5578.502 | 11.794 | **0** |
| Termiticide | 2 | 39137.72 | 82.744 | **0** |
| Concentration | 2 | 4449.48 | 9.407 | **0** |
| Temperature | 1 | 421.508 | 0.891 | 0.345 |
| Soil * Month | 3 | 386.655 | 0.817 | 0.484 |
| Soil * Termiticide | 2 | 831.488 | 1.758 | 0.173 |
| Soil * Concentration | 2 | 31.322 | 0.066 | 0.936 |
| Soil * Temperature | 1 | 32.812 | 0.069 | 0.792 |
| Month * Termiticide | 6 | 553.94 | 1.171 | 0.319 |
| Month * Concentration | 6 | 40.027 | 0.085 | 0.998 |
| Month * Temperature | 3 | 584.451 | 1.236 | 0.295 |
| Termiticide * Concentration | 4 | 225.931 | 0.478 | 0.752 |
| Termiticide * Temperature | 2 | 524.961 | 1.11 | 0.33 |
| Concentration * Temperature | 2 | 13.822 | 0.029 | 0.971 |
| Soil * Month * Termiticide | 6 | 135.174 | 0.286 | 0.944 |
| Soil * Month * Concentration | 6 | 38.423 | 0.081 | 0.998 |
| Soil * Month * Temperature | 3 | 110.334 | 0.233 | 0.873 |

# Discussion


Hydrolysis
Connelly, (2001)
Factor of degradation
Temperature
(Zhu et al 2004).
Photodegradation
Tariq et al., (2017)

# Conclusion

The bioavailability laboratory studies showed that bifenthrin had the lowest $LT_{50}$ and $LT_{95}$ values among termiticide tested

Types of soils and temperature had no significant effects on the degradation and bioavailability of termiticides tested in the laboratory experiment