

The ready biodegradability of woven and nonwoven wet wipes in aerated and sealed bottle test systems ...investigating (miniature) fatbergs

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INTRODUCTION

In recent years wet wipes have become a convenient method of cleaning and disinfecting for a variety of applications (baby wipes, make-up removal, household and commercial cleaning), this project looked at whether there was any difference between the biodegradation of woven and nonwoven wipes and whether any difference in biodegradation was observed in aerated and sealed bottle ready biodegradation test systems.

The OECD TG have a number of different methods to determine ready biodegradation. Some of the differences are:

- Aerating test media vs sealed bottles;
- Biodegradation measurement: CO₂ evolution; O₂ consumption; DOC;
- Test substance concentration;
- Test media concentration;
- Test volume.

AIMS AND OBJECTIVES

- To establish and compare any differences between the aerated and sealed bottle test systems.
- To establish if there are differences in biodegradation for woven and nonwoven materials.

MATERIALS AND METHODS

Woven wipes, nonwoven wipes and nonwoven biodegradable wipes were used in this study.

The OECD 301B and OECD 310 were chosen as both use carbon measurements to determine biodegradation; the OECD 301B is an aerated test system while the OECD 310 is a sealed test system.

Ready biodegradation tests (OECD 301B and OECD 310) were performed using the same batch of activated sludge from a sewage treatment plant (STP) treating predominantly domestic sewage to determine whether any difference in biodegradability was observed with an aerated system and closed bottle system and whether there was a difference between woven and non-woven wipes.

The tests were performed on wipes that had been washed then dried to remove any solvent from them to prevent anti-microbial action from any residual solvent.

After drying each wipe was hole punched to create uniform pieces to dose each test bottle.

Study	Study type	Test substance concentration (mg/L)	TFS concentration (mg/L)	Test volume (L)	Temperature (°C)
OECD 301B	Aerated	20 mg C/L	30	1.5	20 - 21
OECD 310	Sealed bottle	20 mg C/L	30	0.1	20 - 21

Table 1. Studies set up

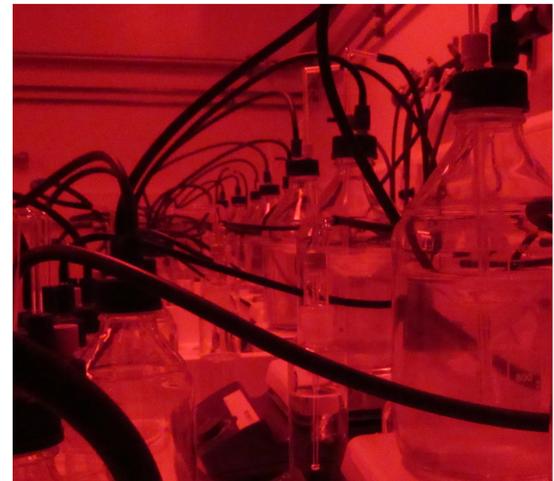


Figure 1. OECD 301B test set up

RESULTS AND KEY FINDINGS

Reference substance and biodegradable wet wipe: On day 14 the reference substance reached 62% biodegradation in the OECD 301B and 88% in the OECD 310 studies.

By day 28 the biodegradable wet wipe reached 71% biodegradation in the OECD 301B and 98% in the OECD 310 studies

Ready biodegradability tests: The nonwoven wet wipe degraded more in both studies than the woven wet wipes (Table 2).

Key findings: The results from both studies show there was little difference in the amount of biodegradation achieved regardless of whether the test system was aerated or sealed test bottle (Table 2). Neither woven or nonwoven wet wipes degraded to any significant level. The nonwoven wet wipes degraded more than the woven wet wipes- this may have been due to the material the wipes were manufactured from: the woven wipes were 100% polyester; the nonwoven wipes were 55% cellulose, 45% polyester. It was observed in the OECD 301B bottles that the sludge and wipes (both woven and nonwoven) coagulated to form a string with the individual pieces of wipe held together in a sludge chain (Fig 3).

Potential further work:

- Investigate whether the wipe material has more impact on the biodegradability of wipes rather than woven or nonwoven construction.
- Investigate different types of ready biodegradation studies (other OECD 301 TG).
- Investigate testing unwashed wet wipes- i.e. wipes tested with solvent impregnated on them.

Day	Percentage biodegradation			
	Woven wet wipes		Nonwoven wet wipes	
	301B	310	301B	310
7	0	1	11	26
14	2	1	24	34
21	0	1	31	33
28	0	1	37	41

Table 2. OECD 301B and OECD 310 biodegradation results



Figure 2. OECD 301B bottle stirrer bar with sludge and wipe chain