Characterization of Plastic Pipes for Wastewater Applications

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Abstract: Plastic pipes are designed as flexible pipes and broadly grouped based on the type of materials the pipes are made. Based on literature review, plastic pipes have been used for wastewater application over the past 80 years. There are number of standard test methods for each type of pipe and also several common test methods. Pipe diameter up to 60-inch is available for storm water application.

1. Introduction

Based on the size and location of the urban cities, millions of gallons of wastewater are discharged daily (Sempere-Payá et al., 2011) and are transported to treatment plants by miles of plastic pipes. Plastic pipes have been used as cross-drainage structures since early 1940 (Zhao et al., 1998). Plastic pipes have become more popular due to their light weight, low cost, ease of transportation and construction. Buried plastic pipes have added advantages such as durability and chemical resistance (Fernando, 1992).

2. Objectives

The overall objective was to characterize and compare the plastic pipes for waste water applications.

3. Plastic Pipes

Advances in material science and engineering have introduced different types of plastic pipes into the market. Plastic pipes are all thermoplastics with varying chemical structures. There are number of standard test methods to evaluate the performance of each type of plastic pipe. Also there are a few common test methods to evaluate the performance of plastic pipes (Table 1). Plastic pipes are designed as flexible pipe and the installation methods of the pipes are critical to ensure the performance of the pipes under normal service conditions.

4. Conclusion

The chemical compositions of each plastic pipe are different and there are number of test methods to evaluate their performance. Compared to other pipe materials, plastic pipes are relatively new but are in service for over 80 years.

5. Acknowledgements

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6. References

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Zhao, J.Q., Kuraoka, S., Baker, T.H., (1998) "Durability and Performance of Gravity Pipes:A State-of-the-Art Literature Review", *Institute for Research in Construction, National Research Council of Canada.*

Fernando, M.E.R., (1992) "Field Performance of Corrugated Plastic Pipes under Simulated High Soil Cover", *M.S. thesis, Ohio University, Athens, Ohio.*

Hoppe, E.J., (2011) "Evaluation of Polypropylene Drainage Pipe", *Virginia Centre for Transportation Innovation and Research, Virginia, Report No. VCTIR 11-R14.*

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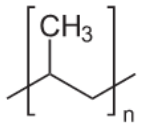
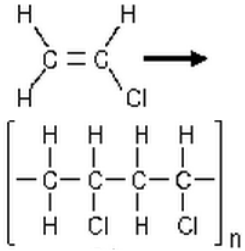
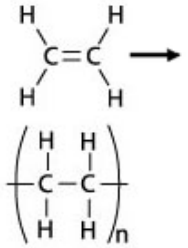
Table 1. Comparison of Plastic Pipes

Type	Composition	Pipe Wall	Pipe Dimensions (For Drainage Appl.)	ASTM Test Standards		Other Specifications	Remarks
				Special	Common		
Polypropylene	Thermoplastic $(C_3H_6)_n$ 	Triple wall, Corrugated single wall and double wall	30 to 60 in	F2764, F2736, F2881	D 2321, F 1417-11a, F 1675-09, F 2422-05, D 2122-98, D 2412-11, D 2444, CIGMAT Joint Infiltration Test.	------	It exhibits excellent mechanical and chemical characteristics, including high strength, stiffness, resistance to stress crack propagation, & resistance to chemical (Hoppe E.J., 2011).
PVC	Thermoplastic 	Triple wall, Corrugated single wall and double wall	12 to 60 in	D 1784, D 1785, D 2152, D 2729, D 2774, D 3034, F 679, F 789, F 949, F 1336, F 1732, F 1760		AWWA C605, C651, M 23, BNQ 3624-050, 3624-130, 3624-135	It is good at chemical resistance up to the temperature of 140^{o} F, corrosion, abrasion and wear resistance. It possess high resistance to fracture and impact damage (Uni-Bell PVC Association, 2001)
High density polyethylene	Thermoplastic 	Triple wall, Corrugated single wall and double wall	2 to 120 in	F 2619, F 2487, F 2136, D 3350		AWWA C901, C 906.	PE piping retains its toughness even at lower temperatures. In addition, PE piping exhibits very high fatigue resistance. Also it resists the propagation of an initial small failure into a large crack (Plastic Pipe Institute).