Dynamic routing of busses

H. E. Andersson

DTU Transport, Technical University of Denmark

INTRODUCTION
With environmental as well as financial incentives for its use, public transportation plays an ever important role in society. In the EU 60 billion passenger journeys were made in 2008 alone, according to the International Association of Public Transport (UITP, n.d.). Increased efficiency in the use of busses is therefore a important step in reducing oil consumption. This project investigates whether a bus fleet can be used more efficiently by using a demand responsive system. Instead of having static routes and time tables that busses follow, a customer would use an app or the web to order a bus to take her from her origin to her desired destination at a certain time. The operator then calculates which bus can serve the customer best and make sure that customer’s request is incorporated in the ever-changing route of that bus. This dynamic solution to public transportation is used by Danish operator Movia with great success in the transportation of the elderly and handicapped, but has so far been deemed inappropriate for use in heavy traffic due to the fact that the quality achievable by current routing methods deteriorate when more people use the service.

THE PROJECT
In this project, a dynamic transportation system is simulated and the quality of the service with respect to travel time and oil consumption is compared with that of a static network. By introducing a completely new routing method that allows for people to transfer between busses, this project aims to greatly increase the quality of dynamic solutions in scenarios with a lot of demand on the service. Since this has earlier been the weakness of demand responsive transit systems, a solution to this problem could cause dynamic routing to outperform static bus systems in far more cases, fundamentally changing the way we will take the bus in the future.

ENVIRONMENTAL IMPACT
All modern bus fleets already have the equipment necessary to transform them into demand responsive transits. Furthermore, since the change is primarily software-based, research on this can immediately be applied world-wide. Even a small increase in efficiency can therefore get great consequences on the global scale, and great savings in oil consumption and CO₂ emissions can be obtained. This constitutes a crucial step on the path to a sustainable world.

REFERENCES

Influence of environmental factors on toxicity of ionizing compounds towards microalgae

H. Wang, K. O. Kusk, and C. Rendal

DTU Environment, Technical University of Denmark

INTRODUCTION
Antibiotics have been largely applied nowadays in water environment and they can affect the metabolism and growth behaviors of the aquatic organisms. The toxicity values of the compounds are always studied with the standardized tests, such as ISO, NOEC or USEPA. These standard tests have a wide tolerance on the conducting environments. However in the real cases, the environmental conditions can largely affect the toxicity behaviors of antibiotics, particularly most of them are ionizing, which probably present larger variences in toxicity values.

Thus in the current study, the influence of environmental factors on the toxicity of two ionizing compounds, salicylanilide (CAS no. 87-17-2) and trimethoprim (CAS no. 738-70-5), was studied. The test aquatic organism is microalgae. Three environmental factors are in focus: pH, temperature and algae cultivation system (open/ closed).

METHOD
The standardized toxicity test method ISO 8692 (2004) was applied. A method development was implemented before the algae toxicity experiments in order to identify stable pH levels, 7, 8 and 9. The pH drift was required not to exceed 1, therefore all the results were checked and only the valid data were taken into further analysis.

RESULTS
pH condition can affect toxicity of ionizing compounds. For the acid salicylanilide, the toxicity decreased when pH increased and the opposite trend illustrated for the base trimethoprim. The correlation between pH and toxicity is mainly caused by the dissociation of the compounds. Temperature and growth rate of microalgae are in the positive correlation in the algae test. It is because most metabolism processes of algae are controlled by enzymes and enzymes are highly temperature-dependent. However, the temperature did not significantly affect the toxicity results. The algae cultivation system can also affect the toxicity results as well as growth rate of microalgae in toxicity test. The closed system indicated higher toxicity of both test compounds towards microalgae and higher growth rate of algae species, compared to open system. The reason may be the higher carbonate concentration in the aqueous phase. However more study needs to be conducted to clarify the question.

CONCLUSION
Three environmental factors in focus can affect the results of algae toxicity test. Influence of pH correlates with the dissociation behavior of the compounds and temperature alter the growth rate of algae species. For different algae cultivation systems, closed system shows higher toxicity of the compounds and higher growth rate of algae, when compared to open one.