

# **2004 TAIWAN INTERNATIONAL SCIENCE FAIR**

**CATEGORY : Environmental Science**

**PROJECT : Study Biological Deoderization using  
Bacteria in Rumen of Ostrich**

**AWARDS : Environmental Science First Award**

**SCHOOL : Gyeonggi Science High School**

**FINALISTS : Song Ho Won**

**COUNTRY : South Korea**

## APPENDIX 2

# ABSTRACT OF EXHIBIT TAIWAN INTERNATIONAL SCIENCE FAIR

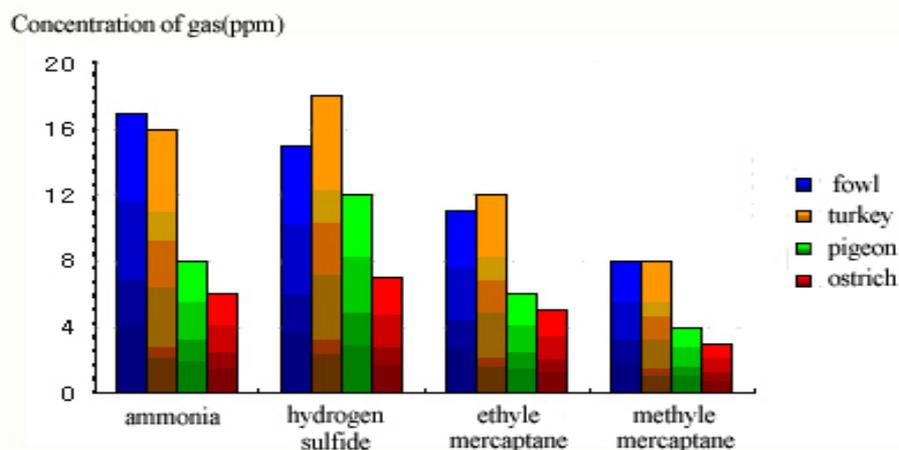
**CATEGORY:** Environmental Science

**TITLE:** Ostrich Enterobacteria as a Promising Biofilter to Eliminate Malodorous Substances

**NAME:** Ho-Won Song

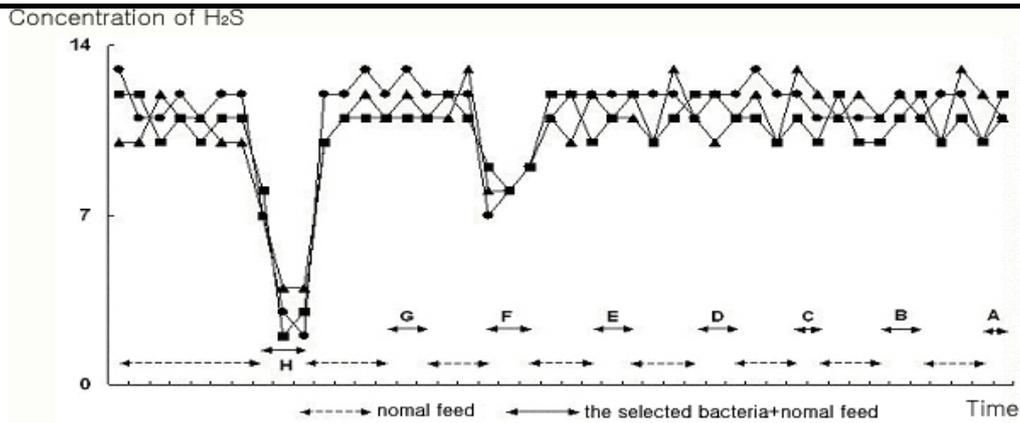
**COUNTRY:** Republic of Korea

**Background:** Although it is well known that, unlike the feces of a fowl, those of an ostrich do not produce foul smell, the impact of different enterobacteria on elimination of malodorous substances has not been seriously investigated. I sought to test the hypothesis that ostrich enterobacteria (OE) are useful to eliminate hydrogen sulfide (H<sub>2</sub>S) and ammonia (NH<sub>3</sub>), two important components of foul smell of the feces.



**Methods:** The effects of 8 different strains of OE (A to H), which could be cultured in the laboratory, were tested both *in vitro* batch test and *in vivo*. Gastec (GV-100S) was used to measure the concentration (ppm) of H<sub>2</sub>S and NH<sub>3</sub>. Batch test as *in vitro* test was used. *In vivo* test, OE mixed with ordinary feed was given to 3 fowls and then the feces of 5g were collected regularly 3 times a day, and water of 10 mL was added to make fecal suspension for measurement of concentration. To identify the specific species showing the highest elimination rate, biochemical test was done using the API kit 20E, and further experiments were done to find out the optimum condition for growth of the species including the dose-response curve. For safety test, oral feeding of selected one OE-strain was executed. Finally, the feasibility of OE as a biofilter was tested using ordinary sewage.

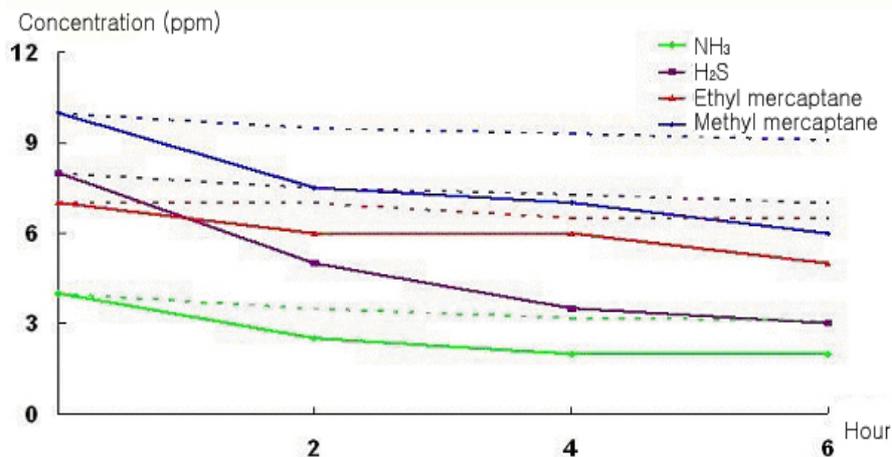
**Results:** *In vitro*, all 8 strains of OE showed significant reduction of concentration of both H<sub>2</sub>S and NH<sub>3</sub>. *In vivo* test, only strain H showed elimination rate > 50% on both H<sub>2</sub>S (73±8.1%) and NH<sub>3</sub> (51±3.1%).



This strain reduced fecal concentration of H<sub>2</sub>S and NH<sub>3</sub> in a dose-dependent manner effectively and during the safety test of 4 weeks, oral feeding of this OE-strain didn't only show persistent reduction of fecal concentration of H<sub>2</sub>S and NH<sub>3</sub> but also there were no serious side effects in gross inspection of the fowls. Biochemical test suggested that this strain is *Providencia rustigianii* (probability > 99%), which is gram (-) bacillus. The most optimum temperature for growth was 40<sup>0</sup>C and pH was between 7 to 9; high concentration of oxygen inhibited the growth of the bacterium.

Reference: H												Read on: 05/17/2003	
Strip: API 20E v3.0													
IND	URE	GLU	MAN	LAC	SAC	MAL	SAL	XYL	ARA	GEL	GRAM		
-	-	+	+	+	+	+	-	-	-	+	-		
ESC	GLY	CEL	MNE	MLZ	RAF	SOR	RHA	TRE	CAT	SPOR	COCC		
-	+	-	+	-	+	-	-	+	+	-	-		
Significant taxa				% Id		T				Test against			
<i>Providencia rustigianii</i>				99.9%		0.73				1			

This OE-strain effectively reduced the concentration of malodorous substances of ordinary sewage, such as H<sub>2</sub>S, NH<sub>3</sub>, ethyl and methyl mercaptane.



**Conclusions:** Elimination of malodorous fecal substances is possible using specific species of ostrich enterobacteria and the most probable bacterium is *Providencia rustigianii*. As this bacterium can be easily cultured in the laboratory and seems to be safe to feed to the livestock, variable application of this ostrich enterobacterium as a biofilter seems to be very promising.

