California Science Center

CALIFORNIA STATE SCIENCE FAIR
2001 PROJECT SUMMARY

Your Name (List all student names if multiple authors.)
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S0401

Project Title (Limit: 120 characters. Those beyond 120 will be ignored. See pg. 9)
Novel Fuel Formulations To Improve Health And Safety By Reduction Of Noxious Emissions

Division
S Junior (6-8) S Senior (9-12)

Preferred Category (See page 5 for descriptions.)
4 - Chemistry

Abstract (Include Objective, Methods, Results, Conclusion. See samples on page 14.)
Use no attachments. Only text inside these boxes will be used for category assignment or given to your judges.

Octane values rate a fuel's resistance to spontaneous ignition of unburned, combustible end-gases. Higher values are promoted as enhancing fuel efficiencies and cleaner burn. Project interest focused on whether varied octane-rated fuels combined with novel fuel additives could effect combustion yielding a reduction in noxious emissions.

Emission values were determined using a modified two-cycle engine (25hp leafblower). Potential fuel additive chemicals, including DMM, DOMDME, ethanol derivative, butane derivative, dimethyl ethyl ketone, DME, and techrolyne (TM) were selected and analyzed. Additive components were measured and mixed under OSHA safety guidelines to produce novel fuel formulations. A non-synthetic two-cycle engine oil was standardized for all samples. Reference samples of commercial grade gasolines having octane ratings of 87, 89, and 92, provided baseline control values. Each respective additive blend was sampled in each octane base. Engine flushing and a clean run occurred between samples. A commerical gas analyzer was used to record emissions data for HC, CO, CO(2), and O(2).

Weighted values of importance were assigned through the use of derived formulas to differentiate which additive combinations yielded lowest emission values. Computer modeling analysis of the underlying chemistry systems related data to hypothesis. Although ethanol and DMM separately yielded high emissions values, the data suggests that in combination these two additives had the lowest emissions.

The project analyzed two-cycle engines because they are numerous, here, and in emerging nations (lawn mowers, marine engines, generators etc), are notorious as "dirty burners", and their emissions have been under studied. Reducing two-cycle engine emissions benefits health, safety and our environment. If the chemistry of combustion can be enhanced by cleaner burning fuel formulations, then reduction of noxious emissions can become a reality.

Summary Statement (In one sentence, state what your project is about.)
This project designed novel fuel formulations to improve health and safety by reducing noxious emissions in two-cycle engines.

Help Received in Doing Project (e.g. Mother helped type report; Neighbor helped wire board; Used lab equipment at university X under the supervision of Dr. Y; Participant in NSF Young Scholars Program) See Display Regulation #8 on page 4.
Dr. Teri Mikita-Judelson supervised our research and helped with forms.