Background

Food and transportation industries waste a large amount of cooking oil and gasoline, and illegal businesses will put these unsafe-protected waste oil back into use, endangering consumer health and aviation safety. It has significant value in the field measurement of the freezing point of oil liquid and solvent.

In winter, in high latitudes, if the freezing point of the aircraft is less than the ambient temperature, it will cause abnormal working conditions and even accidents. And query from the Internet is currently using mechanical pump refrigeration and because of volume expansion can only desktop on the laboratory desktop application. The price is high, between twenty thousand to one hundred thousand yuan, no portable can be measured in the work site oil freezing point instrument.

Purpose

This project uses semiconductor refrigeration plates of small volume, no noise, low cost, low voltage, small power of the freezing point. The advantages of the invention is a kind of portable test instrument, measuring temperature range between 20 to 60 degrees below zero, the volume within the scope of the 30 * 30 * 80 cm, weight within 10 kilograms, the reaction time in 20 minutes, within the cost and the price is in 2000 yuan of the refrigeration equipment.

Principle

Semiconductor disc (TE), also called a thermoelectric disc, is a heat pump. It has the advantage of no sliding parts and is used in some occasions where space is limited, reliability requirements are high, and there is no refrigerant pollution.

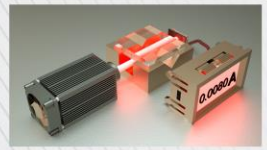
Methods

For cooking oil, different types of oil usually have different freezing points, for example, palm oil and olive oil is 5℃, while soybean oil is -8℃, peanut oil is -10℃, rapeseed oil is -15℃, and blend oil is 2-13℃. The freezing point range of these oils is the same, and we can measure the freezing point of the oil to identify the type of oil and identify the gutter oil or regular cooking oil.

- Four-stage cooling sheet: it is stacked with four cooling sheets of different size and power consumption, which can achieve a wide range of temperature difference and extremely low cooling temperature.
- Heat pipe (vacuum conductor) : A copper tube with a vacuum inside and a special liquid. The liquid at one end absorbs heat and vaporizes, condenses at the other end, and is returned by gravity.
- Tower/down pressure air-cooled fin: up to six heat pipes are installed inside the dense aluminum fin to transfer heat to the fin surface, with the fan to take away the heat.

- Split water cooling technology: the water channel built by water pump, water tank, cold exhaust and other components can transfer the heat of the water to the surface of the cold exhaust to achieve full heat exchange, and the heat is taken away by the fan.

- PID temperature control technology based on single chip microcomputer: a digital control temperature control module, through adaptive adjustment to maintain the temperature at the expected temperature.
- Tilt measurement method: first, solidify the liquid, then tilt 45° to heat up, observe the liquid flow condition, and record the temperature, that is, freezing point, when the flow begins.
- Laser illuminance method: the laser penetrates the liquid to be measured, the value of the other end of the illuminance meter changes, the point where the illuminance no longer drops is the freezing point, and the data is recorded at this moment.



Discuss:

At present, our project has achieved remarkable results in refrigeration, but there are still some shortcomings in freezing point identification and digitization. We have purchased the relevant basic hardware of digital system and started to prepare to build digital platform and develop automatic measurement system. Laser is the method we use to identify the freezing point of oil. Although there is no relevant certificate issued by a third party to support the scientific basis of this method, we will continue to explore new methods and improve the laser method to make it more scientific.

Water-cooled split refrigerator (5th generation)

Air-cooled small refrigerators (first generation)

Small water-cooled refrigerators (first generation)

Results

	Corn germ meal oil (been used) (℃)	Corn germ meal oil (new, brand1) (℃)	Corn germ meal oil (new, brand2) (℃)
t1	-2.6	-15.1	-13.4
t2	-3.8	-17.2	-13.5
t3	-1	-14.9	-12.8
t4	-2.7	-16.2	-12.9
t5	-2.8	-15.4	-13.7
t6	-2.5	-16.1	-12.5
t7	-3	-13.2	-13
t8	-3.2	-14.7	-13.4
Avg	-2.7	-15.35	-13.15

Conclusion:

1. It can be seen from the query that although there are similar research papers, no detailed research and production works, commodities, and patent literature reports in this respect.
2. It is found that the model and size of the refrigeration piece, the specification have a significant impact on the refrigeration effect, not the greater the power, the better.
3. Cooling block requirements small good, large will be affected by the heat transfer around.
4. Four-stage refrigeration effect is better, but the power matching requirements at all levels are high, the higher the level toward the rear power to be more significant.
5. The more critical the heat dissipation requirements, the better. Otherwise, the waste heat cannot be transmitted, the less accessible to refrigeration.
6. Water cooling than air cooling refrigeration effect is good, but the use of relatively troublesome.
7. Heat preservation and heat insulation effect are apparent, compared with the harmful use of heat insulation materials will be more than 20 degrees.
8. In the production of the binder material and whether the effect of false adhesive is significant, once the occurrence of false adhesive will be completely unable to achieve the effect of refrigeration.

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