Neumed, Inc.

HS024

Executive Summary

Neumed, Inc.

- CEO: Kim Hocheol, OMD, Ph.D.
  Professor, Kyunghee Univ.
- Established: April 2003
- Headquarters: Seoul, Korea
- Products: HS024, HP012
  HT008, HP034

Integrative Natural Products Technology Platform ("INTP") is a unique and effective process to develop new drugs from traditional natural products. Neumed, Inc. (Neumed") was founded in 2003 to capitalize on this new technology platform. Neumed uses it's KISTEM subsidiary laboratory and has developed collaborations with many renowned international universities , such as Johns Hopkins University School of Medicine (USA), Beijing Traditional Medicine University (China), University of Pennsylvania School of Medicine (USA), and others.

One of Neumed's lead products, HS024, was synthesized from a natural product (HP074) which was first fractionated, analysed for activity, and then modified by Neumed using the INTP process (Figure 1). HS024 is protected by patents (PCT KR2006/000082) and targets the Stroke market, where there still remains an unmet need.

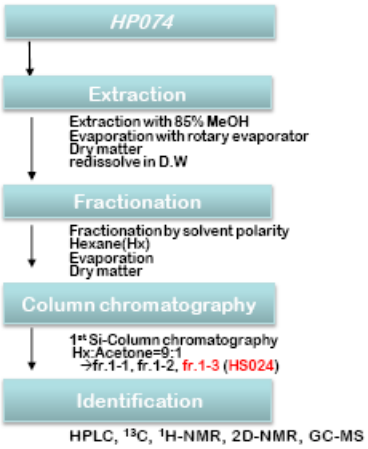


Fig.1. HS024 was derived from INTP process at Neumed

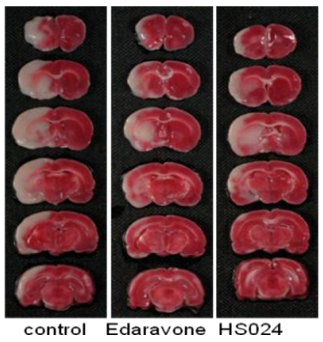
Approximately 3 million people every year suffer a cerebrovascular event (Stroke), and about 1 million people suffer severe brain damage. Stroke is the 3rd leading cause of death in developed countries. Total health care costs caused by Stroke is estimated at over US$ 30 billion annually in the U.S. Although Stroke is a very serious and often lethal event, there are no therapeutic medicines approved in major markets shown to have neuroprotective effects.

HS024 is a validated candidate to satisfy this unmet medical need, and was developed to target the more than US$ 2 billion neuroprotective drug market. Neumed is seeking a co-development partner or licensing partner for this innovative and promising medicine, HS024.

Key Technology Highlights

☐ Improved Protective Efficacy Treating Cerebral Infarction

HS024 shows protective efficacy on cerebral infarction with a 50% improvement observed over a marketed drug (Fig. 2). Compared to Edaravone®, the death rate of HS024 is half of Edaravone®'s after MCAo operation (Table 1). Edaravone®, by Tanabe-Mitsubishi Pharmaceuticals, is the only neuroprotective medicine approved for cerebral infarction, but it was launched only in Japan because of high risk of its side-effects.



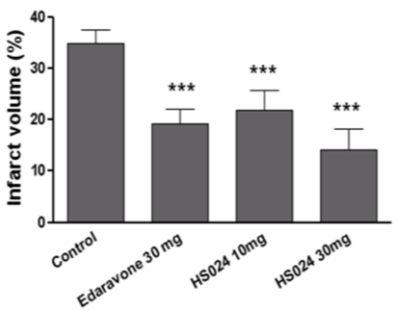


Fig.2. Effect of HS024 on cerebral infarction

Group	No. of Operations	No. of deaths	Death Rate
Edaravone	30	12	40.00 %
HS024	29	6	20.68 %

Table 1. Edaravone versus HS024 : 100 mg/kg, i.v., MCAo (90 min)

☐ Protection effect on cell-death

HS024 protects cerebral cells from LPS-induced inflammation and death in culture. Fig. 3 shows cell survival with HS024 treatment has a linear dose-response effect.

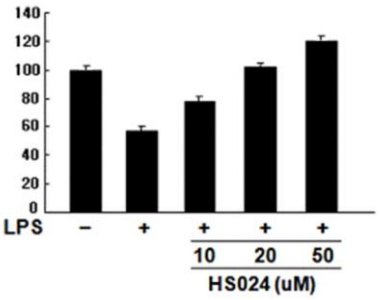


Fig.3. Protection of cell-death by HS024

☐ Anti-inflammation effect

HS024 shows a strong anti-inflammatory effect by suppressing inflammation-related enzymes, such as MMP-3 and COX-2, NO generation, and pons cells activation.

For example, Fig. 4 shows dose-response restraint of MMP-3 by HS024 (bottom line).

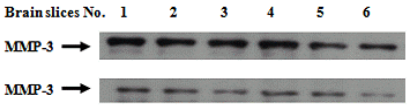


Fig.4. Efficacy of HS024 on MMP-3

☐ Anti-oxidant effect

HS024 activates heme oxygenase-1 (HO-1), an enzyme which has known as anti-oxidant activity. Fig. 5 shows increased percentage of HO-1 enzyme activity by treatment with HS024.

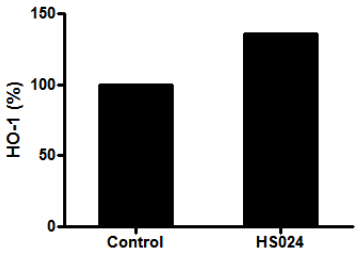


Fig.5. Effect of HS024 on HO-1

☐ Inhibitory effects on MMP2, 9 expression

HS024 inhibits Matrix metalloproteinases (MMP) 2, 9 expression in MCAo rat brain. Fig. 6 shows down-regulated MMP 2, 9 expression by treatment with HS024

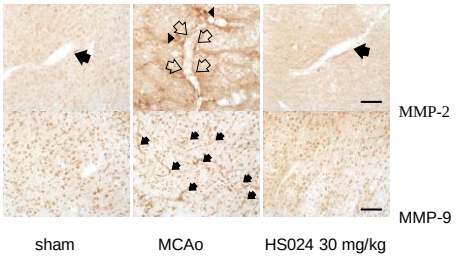


Fig.6. Effect of HS024 on MMP-2, 9 expression in MCAo.

☐ Therapeutic time window of HS024

There was clear difference between the groups to which HS024 was given at 0, 2 and 3 h after MCAo and the vehicle-treated group while no clear difference between 6 h after MCAo group and vehicle-treated group (Fig. 7) (*** $p<0.001$,* $p<0.05$)

☐ Effect of HS024 after pretreatment of GW9662

The effect of HS024 was inhibited by the pretreatment of GW9662, a PPARγ antagonist. The result provides novel insight into the neuroprotective effect of HS024 and its mechanisms of the PPARγ-mediated neuroprotection (Fig. 8.) (* $p<0.001$).

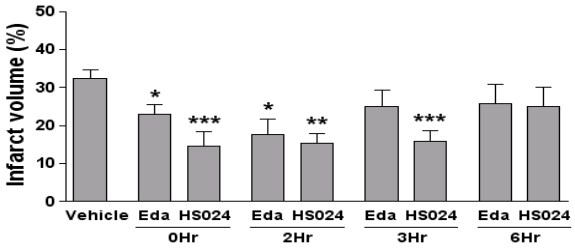


Fig. 7. Effect of HS024 on infarct volume in MCAo rats with various treatment times

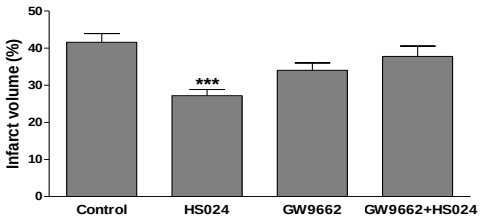
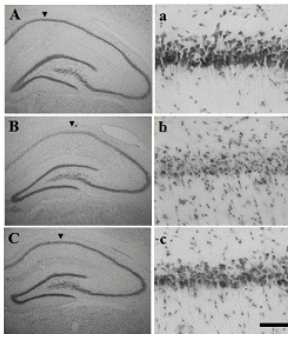


Fig. 8. Effect of OA on infarct volumes in MCAo rats after pretreatment of GW9662.

☐ Effect on Vascular Dementia

HS024 reduces damage on nerve cells more than 70% in a Vascular Dementia animal model. Fig.9. (below) shows that HS024 protects nerve cell damage in Vascular Dementia.



Normal

Cell damaged by Vascular Dementia

HS024 treated

Fig. 9. Nerve Cell protection by HS024 in Vascular Dementia model system