

#22- Characterization of Pleural Fluid

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Client: Dr. Steven Yale

Advisor: Professor Chris Brace

Function:

Dr. Steven Yale has requested a non-invasive, clinical method to characterize the fluid properties of the pleural effusion to determine whether the pleural effusion is exudative or transudative.

Client Requirements:

Cost effective

Portable

User friendly

Accurate

Design Requirements:

1) Physical and Operational Characteristics

a) *Performance requirements*

- i. To determine the fluid properties of the pleural effusion (pH, glucose, catalase, protein content, blood content, specific gravity)

b) *Safety*

- i. No negative biological effects
- ii. Corrosive hydrogen peroxide needs to be well contained
- iii. Minimal exposure of body fluid

c) *Accuracy and Reliability*

- i. Test strips accurately detect concentrations of components of fluid
- ii. Accurately differentiate between exudative and transudative effusion

d) *Life in Service*

- i. Single use

- ii. With additional strips the glucose meter can be reused

e) *Shelf Life*

- i. 3 months
- ii. Strips deteriorate 90 days after breaking seal

f) *Operating Environment*

- i. Patient hospital rooms
- ii. Military zones
- iii. Veterinary hospitals
- iv. Third world countries
- v. Clinics without lab support/ equipment

g) *Ergonomics*

- i. Easily maintained
- ii. Symmetric design
- iii. Consistent layout
- iv. Easy to read

h) *Size*

- i. 10.2cm wide, 12.7cm long, and 1.9cm high

i) *Weight*

- i. 231 grams

j) *Materials*

- i. No latex
- ii. High density polyethylene
- iii. Clear plastic test tube – 8.573cm tall, 1.27cm in diameter

k) *Aesthetics*

- i. Easy to read results
- ii. Symmetrical design

2) Production Characteristics

a) *Quantity*

- i. One model

- b) *Target Product Cost*

- i. \$38.37– with glucose meter

- ii. \$8.38 – without glucose meter

3) Miscellaneous

- a) *Standards and Specifications*

- i. FDA approval is required if placed in the market

- b) *Customer*

- i. Medical schools

- ii. Hospitals

- iii. Military

- iv. Veterinary clinics

- v. Veterinary schools

- c) *Patient-related concerns*

- i. If test is inconclusive, further lab work is needed

- d) *Competition*

- i. Magnetic resonance spectroscopy

- ii. Ultrasound

- iii. Protein analysis